No. 4.— *Zoological Results of a Fifth Expedition to East Africa*

IV

Amphibians from Nyasaland and Tete

By Arthur Loveridge

CONTENTS

INTRODUCTION

The principal collection on which the following report is based, was made by the author while investigating the fauna of the largely deforested mountains of Nyasaland. The enquiry was jointly financed by grants from the Penrose Fund of the American Philosophical Society, and from the Museum of Comparative Zoology on whose behalf it was carried out.

A synopsis of the itinerary is given in the caption accompanying Plate 1 — a map showing the position of the principal collecting localities. Altitudes and other information regarding the various camps will be furnished in the final report of this series which will deal with the general conclusions.

The period of collecting amphibians was from July 29, 1948, to April 18, 1949, during which time 1,680 amphibians, representing 43 species or races, were collected. However, in 1946 (May 27 to October 1) the Vernay-Nyasaland Expedition of the American Museum of Natural History visited the Protectorate in search of mammals, and incidentally gathered 17 amphibians. These Mr. C. M. Bogert of the American Museum submitted to me for identification and incorporation in this report. Of the 10 species collected by the Vernay party only one represented a species I failed to secure in the field. Between us we gathered 43 of the 50 recognizable species or races to be found

in Nyasaland. In listing this material, localities are usually arranged from north to south.

Half a century has elapsed since the last summary of Nyasaland amphibia appeared. Boulenger (1897e, p. 801) then listed 15 kinds of frogs and toads collected by Alexander Whyte; 12 of them allegedly came from the "Nyika Plateau, 6000–7000 ft." This was obviously a case of mistaken labeling for, with one exception, all are low-level species that occur along the lakeshore and were more probably taken by Whyte on the journey down from Kondowe (i.e. Livingstonia, *ca.* 6000 ft.) to Karonga on thelakeshore. Whyte's vague locality "Kondowe to Karonga," is listed as "Karonga to Kondowe," for the species obtained are lakeshore (Karonga) fauna rather than montane (Kondowe = Livingstonia Mission).

Since the turn of the century the only other collection of importance to be made was one by Mr. B. L. Mitchell of the Nyasaland Game and Tsetse Department. Part of it formed the subject of a paper by Dr. A. C. Hoffman (1944b) who listed 17 species. Actually Mitchell has collected nearly double that number, and very kindly placed his unpublished list of records at my disposal so that I might include in this report such as were not open to question.

During the course of the Harvard Expedition 17 additional species or races were added to the fauna of Nyasaland. Of these 7 are here described for the first time as new, viz:

Bufo taitanus nyikae subsp. nov.	Nyika Plateau.
Hyperolius punctieulatus choloensis subsp. nov.	Cholo Mountain.
Hyperolius punctieulatus mitchelli subsp. nov.	Mtimbuka, L. Nyasa.
Phrynobatrachus duckeri sp. nov.	Chitala River.
Phrynobatrachus ukingensis nyikae subsp. nov.	Nyika Plateau.
Arthroleptis xenodactyloides nyikae subsp. nov.	Nchenachena Falls.
Arthroleptis adolfifriederici francei subsp. nov.	Ruo Gorge, Mlanje.

In addition to these new forms, the undermentioned races or species are recorded as entirely

New for Nyasaland

Hyperolius marginatus Peters
Rana galamensis bravana (Peters)
Rana oxyrhynchus gribinguiensis Angel
Rana mascareniensis mossambica Peters
Rana mascareniensis uzungwensis Loveridge

Rana ansorgii Boulenger
Phrynobatrachus perpalmatus Boulenger
Phrynobatrachus ukingensis ukingensis (Loveridge)
Arthroleptis boulengeri de Witte
Arthroleptis reichei Nieden

These additions are largely offset by the necessity of removing from the Nyasaland list a dozen names of species which do not occur, though represented in four instances (indicated with an asterisk) by a race.

Not found in Nyasaland

*Hyperolius concolor** Hallowell, of Liberia
Hyperolius fulvovittatus Cope, of Liberia
Hyperolius fulvoviridis Mitchell, lapsus
Hyperolius cinctiventris Cope, of Natal
Hyperolius horstokii Tschudi, of South Africa
*Rana fasciata** Tschudi, of South Africa
*Rana adspersa** Tschudi, of South Africa
Phrynob trachus acridoides Cope, of Zanzibar
Phrynobatrachus maculatus FitzSimons, of Bechuanaland
*Arthroleptis adolfifriederici** Nieden, of Ruanda
Arthroleptis macrodactylus Boulenger, of Gabon
Arthroleptis variabilis Matschie, of Cameroon
Breviceps verrucosus Rapp, of Natal

In view of my having 44 of the 50 kinds of amphibians known from Nyasaland, and having seen the remaining six at the British Museum, besides having abundant extra-territorial material of most species, it appeared advisable to enlarge the scope of this report so that it might serve as a basis for a herpetology of the country. With this object in view I have included under each species all bibliographical references involving Nyasaland material and, after assessing their probability, all the locality records mentioned. The identification of all Nyasaland amphibia in the British Museum was checked during August, 1952, and any specimens involving previously unpublished localities were added to those listed under *Records*. The published records are followed in parentheses by the initial of the author from whose writings they have been taken. The initials involved are:

B = Boulenger H = Hoffman N = Nieden
G = Günther M = Mitchell P = Peters

Also included are localities taken from a manuscript list of live material

captured by Mr. B. L. Mitchell (M. ms.), to whom I am indebted for this privilege. Only those records were used where the identification seemed beyond doubt. Questionable determinations are omitted as it is unlikely that the actual specimens have been preserved for study purposes.

Other information will be found under such headings as Native Names, Breeding, Diet, Parasites, Enemies, Aestivation, Hibernation, Migration, Habits and Habitat.

ACKNOWLEDGEMENTS

The opportunity is taken of thanking Dr. A. S. Romer, Director of the Museum of Comparative Zoology, for his support of these investigations, and the Trustees of the Penrose Fund of the American Philosophical Society for a substantial grant towards the expenses of the expedition. I am also grateful to the Administration of Nyasaland without whose assistance the execution of my plans would have been well-nigh impossible in a year of almost unprecedented drought and gasoline shortages, and to Mr. B. L. Mitchell of the Fish and Tsetse Department for furnishing me with local information regarding the amphibians in which he is interested.

I am also much indebted to Dr. H. W. Parker and Mr. C. J. Battersby who, during the month I spent in London in 1952, made available to me the Nyasaland material in the British Museum collection. I was thus enabled to see not only the types of ten Nyasaland species, but also to check the conclusions I had arrived at regarding the correct assignment of various specimens identified in very early times by Günther and Boulenger.

To Dr. A. C. Hoffman, Director of the National Museum at Bloemfontein, I am greatly obliged for lending me much of the critical Nyasaland collection reported on by him in 1944. I would also express my thanks to Mr. C. M. Bogert of the American Museum of Natural History for submitting the amphibians collected by the Vernay-Nyasaland Expedition of 1946. Dr. J. T. Lucker has kindly identified the parasitic worms.

Dr. Walter C. Brown of Northwestern University obligingly made a critical examination of our extensive *Hyperolius nasutus* material, and I am also indebted to my colleague, Mr. Benjamin Shreve, for frequently giving me the benefit of his opinion as noted in various places in the text. For the photographs illustrating this report I wish

to thank my wife and her sister, Miss Hilda Sloan, who accompanied me during the first part of the trip.

SUMMARY OF TAXONOMIC ALTERATIONS

Trinomials, which were not employed by Boulenger for indicating geographical races, are required for no less than 31 of the 51 forms dealt with in this report. Among them the following are used for the first time:

Scolecomorphus kirkii Boulenger becomes *S. k. kirkii* Boulenger
Megalixalus brachycnemis Boulenger " *Afrixalus b. brachycnemis* (Blgr.)
Hyperolius albofasciatus Hoffman " *H. marmoratus albofasciatus* Hoffman
Hyperolius tuberilinguis A. Smith " *H. concolor tuberilinguis* A. Smith
Rappia puncticulatus Pfeffer " *H. p. puncticulatus* (Pfeffer)
Rana mossambica Peters (revived) " *R. mascareniensis mossambica* Peters
Rana fülleborni Nieden (revived) " *R. fasciata fülleborni* Nieden
Arthroleptis ukingensis Loveridge " *Phrynobatrachus u. ukingensis* (Loveridge)
Phrynobatrachus mababiensis FitzSimons = *P. u. mababiensis* FitzSimons

Half a dozen species proposed by Hoffman, as well as some earlier names, are considered synonyms, viz:

Chiromantis umbelluzianus Ferreira = *C. xerampelina* Peters
Leptopelis bocagei haasi Mertens = *L. bocagii* (Günther)
Hylambates johnstoni Boulenger = *Leptopelis flavomaculatus* (Günther)
Kassina s. ovamboensis Hoffman = *K. senegalensis* (Duméril & Bibron)
Hyperolius insignis Bocage = *H. marmoratus parallelus* Günther
Hyperolius toulsoni Bocage = *H. marmoratus parallelus* Günther
Hyperolius k. smaragdinus Laurent = *H. concolor tuberilinguis* A. Smith
Hyperolius s. loveridgei Laurent = *H. concolor tuberilinguis* A. Smith
Rappia granulata Boulenger = *Hyperolius nasutus* Günther
Rappia oxyrhynchus Boulenger = *Hyperolius nasutus* Günther
Hyperolius acuticeps Ahl = *Hyperolius nasutus* Günther
Rana nyassae Günther = *R. fuscigula angolensis* Bocage
Rana anchietae Bocage = *R. o. oxyrhynchus* A. Smith
Rana porosissima Steindachner = *R. subpunctata* Bocage
Rana chobiensis FitzSimons = *R. subpunctata* Bocage
Rana Vernayi FitzSimons = *R. mascareniensis mossambica* Peters
Arthroleptis rosei Hoffman = *Rana d. delalandii* (Dum. et Bibr.)
Phrynobatrachus vanrooyeni Hoffman = *P. u. mababiensis* FitzSimons
Phrynobatrachus chitialaensis Hoffman = *P. u. mababiensis* FitzSimons
Breviceps mitchelli Hoffman = *B. mossambicus* Peters
Phrynomerus b. nyasalandensis Hoffman = *P. b. bifasciatus* (A. Smith)

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* Unknown in Nyasaland as yet, though probably occurring on Lower Shire.

SYSTEMATIC DISCUSSION
CAECILIIDAE

Scolecomorphus kirkii kirkii Boulenger

Scolecomorphus Kirkii Boulenger, 1883b, Ann. Mag. Nat. Hist. (5), **11**, p. 48: "Probably vicinity of Lake Tanganyika." (*vide infra*). Günther, 1893 (1892), p. 555; Boulenger, 1895a, p. 413, pl. xxiii, figs. 3–3c; K. Peter, 1895, p. 183, figs. 1–6; Johnston, 1897, p. 362; 1898, p. 361a; Nieden, 1912b, p. 192; 1913a, p. 28; Mitchell (as caecilian only), 1946, p. 33.

2 (A.M.N.H. 53239–41) Zomba Plateau. 27.v–11.vi.46.
3 (A.M.N.H. 53242–43) Cholo Mountain. 18.ix–1.x.46.
26 (M.C.Z. 27101–20) Cholo Mountain. 11–30.iii.49.

Records. Shire Highlands (G); Zomba Plateau (M). As I (1933h, p. 350) have taken *kirkii* in the Ubena Highlands of Tanganyika Territory, it should occur in northern Nyasaland where, owing to the absence of rain, I failed to find it.

The type locality of *kirkii* has been long in doubt, a point that assumes some importance as I propose regarding *ulugurucnsis* Barbour and Loveridge as a subspecies. Dr. H. W. Parker, to whom I wrote on the matter, has very kindly supplied me with the following information.

No localities whatever appear in the original listing of this Kirk collection in the British Museum register for 1882. Later someone added: "Collected at Mpwampwa." Subsequently this entry had been struck out and in its place was written: "Sent by Sir. J. Kirk, collected probably about Lake Tanganyika." On what grounds this alteration was made is unknown, unless it was based on a letter from Kirk written the week before the collection was registered. This letter states that, on the day of writing, a case of specimens in spirit, which had not been opened since Kirk's departure from Zanzibar, had been left at the addressee's (? A. Günther's) house, No mention is made of amphibians or reptiles, only of beetles and various mammals, some of which were from Zanzibar but one monkey from the "Manyema country West of Lake Tanganyika."

Dr. Parker continues that "Nyasaland" given in Boulenger's 1895 paper in the Proceedings of the Zoological Society, was not intended as an emendation of the type locality but as the range, Nyasaland being the only country from which specimens with precise locality had been received.

Dr. G. Arnold, Director Emeritus of the National Museum of Southern Rhodesia, told me in 1949 that some years ago he came upon the remains of a partly digested caecilian, possibly dropped by a bird, on Mount Gomo, popularly known as Mount Pork Pie, lying to the west of Melsetter, Southern Rhodesia.

If caecilians do occur on the mountains in the vicinity of Melsetter, it implies a 300-mile southward extension of range for the family. At present the most southerly member being *kirkii* on Cholo Mountain. In view of the links between Mount Selinda near Melsetter and the fauna of Mlanje Mountain, on which *Scelotes arnoldi* has now turned up, there is no reason for doubting the possibility.

Native names of Kirk's Caecilian. *Nianta* (pl. *mianta:* Nyanja on Mlanje, where the Natives say it occurs); *nyongolotzi* (Manganja on Cholo; but according to Sir Harry Johnston (1897, p. 365, footnote) *nyongolozi* is an earthworm).

Variation. Body annuli (counted along left side and including the prominent pair on throat together with the indistinct groove following) 131–152, average 143 (extremes checked); 134–150, average 143.7 in seven specimens in the British Museum. A scarcely discernible, darkly pigmented spot beneath the skin of the younger specimens, but absent in adults, indicates the presence of an eye. It seems probable therefore, that the specimen without locality or other data, sent to the Berlin Museum by Boulenger as *kirkii*, but transferred to "*Boulophis rittatus*" by Nieden (1912b, p. 192) on account of the presence of an eye spot, may well have been *kirkii* whose orbit becomes roofed over with bone only in later life. In life, *S. rittatus* and *kirkii* are readily distinguishable by color and usually by number of annuli.

But, except for color, there now seems little to distinguish *attenuatus* Barbour & Loveridge, 1928, of the Uluguru Mountains at 8000 feet in Tanganyika Territory, from *kirkii*, of which it is best regarded as a northern race.

Color in life. Above, glossy black; sides brownish. Below, white anteriorly becoming — towards midbody — minutely speckled with pink, the specks so concentrated posteriorly as to produce a general pink appearance.

Size. Midbody diameters 7 to 10 mm., included from 32.2 to 46.4 times in the total lengths of from 270 mm. (M.C.Z. 27111) to 400 mm. (M.C.Z. 27101). The type and six (five rather dried) other specimens in the British Museum range from 3.5 to 11 mm., included from 35 to 52.8 times in the total lengths of from 185 (B.M. 92.12.31.45) to 451

(B.M. 93.10.26.94) mm.

Diet. M.C.Z. 27111 is preserved in the act of swallowing an earthworm.

Habitat. Strangely enough none was found in Cholo Forest, even when sodden with rain, though repeated search was made for them during the fortnight we were there. The Cholo specimens in the American Museum were found beneath a pile of vegetation cleared from the camp site just below the forest. On the same spot one came wriggling towards my tent awning during a downpour. It was owing to the heavy rains that fell during our stay on Cholo that I was able to secure this fine series of a species of which less than a dozen are known.

PIPIDAE

Xenopus laevis laevis (Daudin)

Bufo laevis Daudin, 1803, Hist. Nat. Rainettes, p. 85, pl. xxx, fig. 1: No locality.
Xenopus laevis Mitchell, 1946, p. 29.

6 (M.C.Z. 27121–6) Nchisi Mountain. 6.xii.48.
1 (M.C.Z. 27127) Mnema, Makanjila. 16.xii.48.

Records. Highlands of Nyasaland (Mitchell: who writes that he refers to Blantyre; Cholo; Limbe and Zomba. Mitchell is the first to take this species in Nyasaland where, however, it is not restricted to the highlands, for Mnema is on the shore of Lake Nyasa just north of Salima). One would have expected Nyasaland frogs to be referable to *l. petersii* Bocage of Angola (inc. *poweri* Hewitt of S. Rhodesia) but comparison with our abundant Angolan material reveals that this is not the case. Moreover, the prehallux conforms more nearly to that of typical *laevis* than to *l. borealis* Parker of Kenya Colony.

Native name of Smooth Clawed-Frog. *Tesi* (Chewa; Ngoni).

Variation. Vomerine teeth absent; subocular tentacle much shorter than half the orbital diameter; metatarsal tubercle small and blunt; black claws appear flattened when viewed from above.

Color. Underside immaculate in four young, vermiculated with gray or brown in the three ♂♂ of 52–55 mm.

Breeding. The smallest (M.C.Z. 27123) is 56 mm. over all, of which the tail comprises half.

Parasites. A ♂ nematode (*Camallanus* sp. probably *C. kaapstaadi*) was present in the digestive tract of the Mnema frog, the walls of

whose stomach and intestines were plastered with encysted Physalopterid larvae, probably *Spiruroidea*.

? *Hibernation*. On learning from Mr. Mitchell that he had taken *Xenopus* in the Lake Dam on Zomba Plateau between May and November, 1944, I made intensive, but unsuccessful, search for them on various occasions between September 1 and 13. As this was the cold season with nightly temperatures of 45° to 50°, often accompanied by a chill wind, I suspect these aquatic amphibians were hibernating in the mud far out in the lake. So deep was this mud on the periphery of the lake that even when wearing fishermen's thigh-boots one could not wade far from shore, and forcing our nets through the mud there brought up neither frogs nor tadpoles. There is the possibility, though it seems unlikely, that the *Xenopus* may have been swept away by the great flood of December, 1946, which adversely affected the trout population on Zomba.

Migration. When I mentioned the migration of *X. muelleri* (*vide infra*) to Prof. C. A. du Toit, he told me that in a lifetime spent in South Africa he had never seen one, though he had heard of *l. laevis* migrations in the Western Province. Curiously enough he had witnessed a migration of *l. borealis* when on a brief visit to Kenya Colony in January, 1934. He was collecting on the Doinyo Lessos Estate at Eldoret at the time. It occurred on a bright clear day shortly after sunrise while the vegetation was still wet with dew. Through this damp grass the frogs were advancing over a front of about ten yards in width as they proceeded from one shallow pool to another about fifty yards away.

Xenopus muelleri (Peters)

Dactylethra Muelleri Peters, 1844, Ber. Akad. Wiss. Berlin, p. 37: Mozambique. Peters subsequently (1854) revealed that his material came from Boror, Cabaçeira, Sena and Tete; it is advisable to restrict the type locality to Tete, Zambezi River, Mozambique.

Xenopus muelleri Boulenger, 1897e, p. 801; Johnston, 1898, p. 361a; Nieden, 1915, p. 387; Hoffman (as *meulleri*), 1944b, p. 173; Mitchell, 1946, p. 29.

3 (M.C.Z. 27128–30) Chitala River. 18.xii.48.
17 (M.C.Z. 27131–39) Mtimbuka. 7–25.ii.49.
9 (M.C.Z. 27140–8) near Boroma, M. 25.i.49.

Records. Chitala (as Chitiala: H); Fort Hill[1] (B); Karonga to Kondowe (B); Lake Nyasa (N); "Nyika Plateau" (B: an obvious error); Rift Valley of Nyasaland (Mitchell: who writes that he refers to Chitala; Chikwawa; Chiromo; Port Herald).

Native names of Mueller's Clawed-Frog. *Kalololo* (Nyungwe); *namwonde* (Yao).

Variation. Vomerine teeth present or absent in adults; subocular tentacle at least half the orbital diameter (though on one side of M.C.Z. 27135 and 27138–9, it is much shorter, doubtless the result of accidents); metatarsal tubercle prominent, papilla-like, with blunt tip (*not* pointed as so frequently alleged); black claws appear compressed when viewed from above.

Color. Underside vermiculate with gray in young; usually in adults also, though a few are almost immaculate; hind limbs (except in M.C.Z. 27146) rather heavily blotched or spotted with black.

Size. Length of ♂ (M.C.Z. 27130) from snout to anus, 58 mm.; of largest ♀ ♀ (M.C.Z. 27128–9; 27131; 27139), 72 mm.

Breeding. The four large ♀ ♀ mentioned above were full of ova in mid-December and mid-February respectively.

Enemies. While in Mozambique I was especially anxious to obtain representative examples of *muelleri* but, owing to the widespread drought, the only standing water was in Boroma swamp many miles west of Kasumbadedza. To reach it from the road we had to cross several hundred yards of mud, strewn with the large olive shells of water snails that had lately perished by the thousand as the receding water exposed them to the tropical sun. Already the water had shrunk to two great pools surrounded by such deep mud as to render them quite unapproachable. I halted, realizing my intention of netting *Xenopus* was quite impossible, and with it my only hope of securing Mozambique material of *muelleri*.

At the water's edge were a group of miscellaneous wildfowl that included three Hammer-headed Storks (*Scopus umbretta bannermanni*). One of them, disturbed by my approach, took to wing and was passing almost overhead when I shot it. Carried onwards by the momentum of its flight, the bird planed downwards to the hard-caked mud behind us. My gunbearer turned and ran to retrieve the dead stork. On reaching it he called to me to come and see, then pointed to three of the frogs I so much wanted. The slimy amphibians lay in

[1] The 47 mm. specimen is now too macerated to be certain of identification, but I should refer it to *l. laevis* on the basis of the very short tentacle which, of course, may have become truncated; the black claws are all missing.

a line ahead of the stork's bill, having slid from its gullet as it hit the ground. Later, when preserving the skin, we found in gullet and stomach five more *Xenopus*, all so recently swallowed I was able to preserve them as specimens.

Aestivation. At one place where elephant grass was growing at the edge of the original swamp, the mud was already deeply fissured. Far down at the bottom of a crack where they could not be reached, lay two *Xenopus* on their sides. Presumably in similar pockets of damp mud, far below the sun-baked surface, some frogs would survive until the area was reflooded by the returning monsoon rains.

Migration. As a result of several heavy downpours during the first few days of February, a deep pool formed in the bush a hundred yards or so to the rear of the Mtimbuka house. Immediately behind the house, which fronted on Lake Nyasa, was a bare, sandy, well-swept back yard. When the monsoon rains failed to materialize, the pool rapidly shrank under the hot rays of the sun. Happening to go out into the yard late on the afternoon of February 25th I encountered a dozen clawed-frogs all leaping clumsily across the bare ground in the direction of the lake. On reaching the house, which was directly between them and their objective, they jumped against the wall a few times in futile fashion, then turned to left or right until they cleared the obstacle. By following along the wall I was able to pick up fourteen frogs in less than ten minutes, and could easily have got many more.

BUFONIDAE

Bufo carens Smith

Bufo carens A. Smith, 1849, Illus. Zool. S. Africa, **3**, pl. lxviii, fig. 1: Interior of Southern Africa. Hoffman, 1944b, p. 174; Mitchell, 1946, p. 42.

5 ♀♀ (M.C.Z. 27149–53) Chitala. 14.xii.48.

Records. Chitala (as Chitiala); Fort Johnston (M.ms.); Mzimba (Brit. Mus.). The first published record of the occurrence of this species in Nyasaland was based on Mitchell's material, a fact overlooked by Hoffman.

Native names of Red Toad. This name, proposed by Mitchell, is descriptive and preferable to Malcolm Smith's suggestion of Slender Toad, which is misleading. Mitchell gives *conga* (Sena at Port Herald); *naliwonde* (Yao); *zonde* (Cewa at Dowa; Manganja at Chikwawa).

Variation. Eye subequal to, or slightly smaller than, the transverse diameter of tympanum; parotid glands absent or indistinct; a post-temporal and dorso-lateral glandular fold separating dorsum from flanks; first and second fingers subequal when adpressed; a tarsal fold; toes slightly webbed.

Size. Snout to anus 89–92 mm.

Breeding. Both largest and smallest full of spawn.

Enemies. Three recovered from stomach of a Verreaux Eagle-Owl (*Bubo lacteus*), one from a White-lipped Snake (*Crotaphopeltis h. hotamboeia*) while a fifth was in process of being swallowed by a *hotamboeia*.

Bufo regularis regularis Reuss

Bufo regularis Reuss, 1834, Mus. Senckenberg, **1**, p. 60: Egypt. Boulenger, 1882b, p. 298; Günther, 1893 (1892), p. 555; 1895, p. 526; Boulenger, 1897e, p. 801; Johnston, 1897, p. 362; 1898, p. 361a.

♀ (A.M.N.H. 53247) Cholo Mtn. 18.ix.–1.x.46.
♂ ♀ (M.C.Z. 27154–5) Misuku Mtns. 7.x.48.
5 juv. (M.C.Z. 27526–9) Nchenachena. 20.xi.48.
♂ (M.C.Z. 27156) Nchisi Mtn. 6.xii.48.
♀ (M.C.Z. 27157) Chitala R. 14.xii.48.
2 juv. (M.C.Z. 27158–9) Mnema. 16.xii.48.
♂ (M.C.Z. 27160) Mtimbuka. 7.ii.49.
♂ (M.C.Z. 27161) Zomba Plateau. 4.ix.48.
3 ♂♂, 4 ♀♀, 1 juv. (M.C.Z. 27162–8) Chiradzulu Mtn. 26.viii.48.
1 juv. (M.C.Z. 27169) Hynde's Dam, Limbe. 27.xii.48.
♀ (M.C.Z. 27170) Cholo Mtn. 11.iii.49.
9 ♂♂, 4 ♀♀ (M.C.Z. 27171–5) Likabula R. 29.vii.48.
♀ & 19 juv. (M.C.Z. 27176–9) near Tete, M. 6–22.i.49.

Records. I also caught, examined and released specimens of *regularis* at Blantyre; Chinunkha; Chowe; and Ruo River. Fort Hill (B); Karonga to Kondowe (B); Nkata Bay to Ruarwe (B); Nyika District and "Plateau"[1] (B); Shire Highlands (G); Zomba and Zomba Plateau. (Brit. Mus.).

Native names of Square-marked Toad. *Bota* (Chewa); *chula* (Misuku; Yao); *chulé* (Nyanja); *chula tengu* (Nyungwe).

Variation. Eye usually much larger than the transverse diameter of

[1] The single small specimen allegedly from the Plateau possesses both tympanum and tarsa fold.

tympanum; parotid glands conspicuous throughout life; neither a post-temporal nor dorso-lateral fold; first finger longer than second when adpressed; a tarsal fold (inconspicuous in very young); toes about half to two-thirds webbed. Least webbed in the 80 mm. ♀ from near Tete.

Size. Snout to anus 11 mm. (M.C.Z. 27176) to 87 mm. (♂, M.C.Z. 27156 and ♀, M.C.Z. 27155).

Breeding. Spawning on July 29 and August 26; calling on September 4 in response to crackling of a bush fire in vicinity of river; calling on September 22, October 18, 22; January 6 and February 7; 11–30 mm. juveniles abundant under damp debris on bank of Zambezi, January 22; 13–15 mm. juveniles on November 20; 17–30 mm. juveniles on August 26, December 16 and 25.

Enemies. Two in stomach of cobra (*Naja n. nigricollis*) at Likabula; one in night adder (*Causus rhombeatus*) at Nchenachena.

Bufo taitanus nyikae subsp. nov.

Type. M.C.Z. No. 27180, a gravid ♀ from my tent on the Nyika Plateau above Nchenachena, at 7500 feet, Nyasaland. Collected by Arthur Loveridge, November 2, 1948.

Paratypes. M.C.Z. Nos. 27181–9 and six uncatalogued ♂♂, being in all nine ♂♂, three ♀♀, and three juveniles from the same general region as the type but collected November 1 to 15, 1948.

Diagnosis. Distinguished from the typical form (with a cotype of which it has been compared) by its larger size — ♀♀ 35–42 mm. (32 mm. is maximum for *t. taitanus* Peters of which we have several of that size from Chifumbazi, Mozambique), as also from *t. uzunguensis* Loveridge (gravid at 28 mm. from the Uzungwe; Ubena; and Poroto Mountains of Tanganyika). Though in size approaching *t. taitanus*, the new race differs in lacking the dark pattern on breast and belly so characteristic of the typical form, while it has a light vertebral line.

While usually agreeing with *t. uzunguensis* (to which it keys down in my synopsis — 1932g, p. 50) in possessing a hairlike vertebral line from snout to anus, the line is absent from snout and crown in four (2 ♂♂, 2 juv.) paratypes, as in the much smaller *t. beiranus* Loveridge (gravid at 22 mm.), the holotype of which I have re-examined and compared with the paratypes of *nyikae*.

Description. Essentially like that of the typical form except in

respect to characters mentioned in the *Diagnosis*. Tympanum absent; parotid glands flat and elongate; neither a post-temporal nor dorso-lateral fold; first finger shorter than second when adpressed; no tarsal fold; toes not, or but barely, webbed at base.

Size. Snout to anus. Juveniles 13, 15 and 17 mm.; ♂♂, 28, 30, 30, 31, 31, 32, 32, 34 and 34 mm.; ♀♀, 35, 36, 39 and the type of 42 mm.

Breeding. In mid-November following showers, several were taken in axillary coitu, a 30 mm. ♂ (M.C.Z. 27182) and 39 mm. ♀ (M.C.Z. 27183) remained so when anaesthetized and are so preserved. They were captured at dawn in one of the boys' tents and two other pairs were also found hopping about out of water for which they were presumably seeking.

Enemies. The foot and belly skin of an adult were recovered from the stomach of a Harsh-furred Mouse (*Lophuromys a. aquilus*), and an entire toad (preserved) from a snake (*Psammophylax t. variabilis*).

RHACOPHORIDAE

Chiromantis xerampelina Peters

Chiromantis xerampelina Peters, 1854, Ber. Akad. Wiss. Berlin, p. 627: Tete and Sena, Mozambique.

Chiromantis umbelluzianus Ferreira, 1921, Jorn. Sci. Lisboa (3), **2**, p. 205, pls. i–ii: Posts of the Umbelluzi Bridge, 50 km. from coast, Lourenço Marques district, Mozambique. Hoffman, 1944b, p. 180; Mitchell, 1946, p. 33.

10 ♀♀ (M.C.Z. 27190–8) Chitala R. 14–17.xii.48.
2 ♀♀ (M.C.Z. 27199–200) Mtimbuka. 4.ii.49.
♂ (A.M.N.H. 53244) Cholo Mtn. 18.ix.–1.x.46.

Records. Chitala (as Chitiala: H). Chikwawa; Chiromo; Fort Johnston (M. ms.); Lake Malombe (Brit. Mus.); Monkey Bay; Port Herald(M. ms.); Ruo District (Brit. Mus.)

Variation. Disk of longest finger slightly smaller than, or equal to, the tympanum; outer finger half to three-quarters webbed; no tarsal fold; tibio-tarsal articulation of the adpressed hind limb attains the tympanum (in 4), posterior corner of orbit (in 7) or the eye (in 1).

Synonymy. C. umbelluzianus was apparently separated by Ferreira on the grounds that the vomerine teeth were allegedly less prominent; the tympanum was half the orbital diameter; and the fingers were one-third, instead of half, webbed. As the amount of webbing varies from finger to finger it is necessary to be more specific. Ahl (1931c, p. 38) referred specimens from Cabaçeira and Tschimbo (now M.C.Z.

17624) to *umbelluzianus* on entirely different grounds, viz. disks rather larger than the tympanum; (instead of allegedly three-quarters in *xerampelina*); and tibio-tarsal articulation of adpressed hind limb attaining to posterior corner of eye or not so far (allegedly from eye to snout in *xerampelina*).

Hoffman (1944b) referred two of Mitchell's Chitala frogs to *umbelluzianus* presumably because their tibio-tarsal articulations reached the posterior corner and middle of eye, respectively, for he states that the tympana were two-thirds the eye diameter. After careful consideration of all these statements I refer *umbelluzianus* to the synonymy as the Umbelluzi Bridge is in the same general region as Mazambo, Limpopo River, from which come frogs (M.C.Z. 7258, 20809) that are definitely *xerampelina*.

Size. Snout to anus of ♂, 58 mm.; of ♀ ♀, 60–87 mm.

Breeding. All the ♀ ♀ held ova. At Mtimbuka a halfgrown ♀ was found on the bookcase of a house that had been closed for some time. I removed it to a bookcase close beside my table where it remained quietly though tools were constantly taken up or laid down within a couple of inches of it. The same evening, February 4, after a shower, *Chiromantis* commenced calling a hundred yards away and my frog left the room and hopped across the back veranda in the direction of the calls. I returned it to the room and shut it in. The following night it was again restless and crossed the room where I found it squatting beside the closed door leading to the veranda. On the 7th a pair of *Chiromantis* were spawning on a branch above a pool and about a hundred yards from the back veranda.

Aestivation. Under favorable conditions this would appear to be only partial. At Chitala, Mr. H. C. Ducker invited my attention to three of these frogs which were squatting on three picture frames in widely separated parts of the lounge, where they had been ever since the cessation of the rains seven months before. Though there was evidence that they moved about at night, feeding on insects attracted by the electric lights, by morning they were always back on the same three frames though there were a great many others scattered around the room. When Mr. Ducker experimentally transferred them to other frames they always returned to their original choice by morning. As, however, the amphibia were not individually marked, this is something of a well-founded assumption. Less certain was their sex, thought to be males as they were of small size, about 60 mm. or under.

Outside on the veranda, squatting upon an ornamental bracket

carrying an electric light (see pl. 4, fig. 1), were three large females, also apparently awaiting the arrival of the monsoon. However, on the night of November 28 when there was an isolated downpour and the veranda was lashed by cold rain driven before a blustering wind, the three frogs deserted their bracket and sought shelter in Mr. Ducker's bedroom. One would have supposed that after a six months' drought accompanied by very high temperatures, the amphibians would have enjoyed a wetting.

Leptopelis bocagii (Günther)

Cystignathus bocagii Günther, 1864c, Proc. Zool. Soc. London, p. 481, pl. xxxiii, fig. 2: Duque de Bragança, Angola.

Leptopelis bocagei Parker, 1936d, p. 97 (includes Nyasaland).

Leptopelis bocagei haasi Mertens, 1937b, Abhand. Senckenberg. Naturf. Ges., No. 435, p. 21, fig. 2: Nsombo, Lake Bangweolo, Northern Rhodesia.

Hylambates bocagii Hoffman, 1944b, p. 180, fig. 7.

♀ (M.C.Z. 27201) Nchisi Mtn. 1.xii.48.
♂ (M.C.Z. 27202) Cholo Mtn. 22.iii.49.

Records. Chitala (as Chitiala: H). Blantyre; Limbe; Zomba (M. ms). Zomba (Brit. Mus.).

Native name of Bocage's frog. *Finye* (Chewa; Ngoni; Nyanja). Mitchell (1946, p. 42) gives this name as that of *Breviceps* in Cewa and Manganja, his informants may have been confused. As this is a burrowing species "Bocage's Tree Frog," proposed by Malcolm Smith (1929, p. 307), is inappropriate as an English name.

Variation. Tip of longest finger included 2 to 2½ times in diameter of tympanum; digital disks virtually lacking; fingers without web; toes with a trace of web at base; tibio-tarsal articulation of adpressed hind limb reaches axilla in ♀, tympanum in ♂.

Synonymy. Parker (1936d) has done much to clarify the status of this frog. However, his friendly suggestion that my inclusion of *anchietae* Bocage (1873) in the long synonymy of *bocagii* was a slip, is not wholly correct. I was led to do so after examination of the material erroneously identified by Noble (1924) as "*anchietae*", a species or race which, at that time, I had not seen.

Hoffman's nomenclature suggests that he was unaware of both Parker's and Mertens' papers. I rather suspect that Mertens' paper went to press before he had seen Parker's, for *haasi* appears to agree perfectly with typical *bocagii*, suggesting that what Mertens regarded

as typical *bocagii* may have been *anchietae*. I submitted a copy of these remarks to Dr. Mertens who replies that in the absence of any topotypical *anchietae* he cannot offer an opinion.

Laurent (1941c, p. 101), whose liking for subgeneric names is not shared by all his colleagues, has made *bocagii* subgenotype for his *Taphriomantis*.

Size. Snout to anus of ♂, 53 mm.; of ♀, 60 mm.

Enemies. One recovered from stomach of a night adder (*C. rhombeatus*) at Cholo.

Habitat. Following heavy rain the Nchisi frog was taken in the vegetable garden by Miss H. L. Sloan.

Leptopelis flavomaculatus (Günther)

Hyperolius flavomaculatus Günther, 1864b, Proc. Zool. Soc. London, p. 310, pl. xxvii, fig. 1: Rovuma Bay, Tanganyika.

Hylambates johnstoni Boulenger, 1897e, Proc. Zool. Soc. London, p. 803, pl. xlvi, fig. 4: Kondowe to Karonga, Nyasaland.

Johnston, 1897, p. 362; 1898, p. 361a; Boulenger, 1898b, p. 475.

Records. The type locality of *johnstoni* is being restricted as above for, in all probability, the fourth cotype of this coastal plain species never came from the "Nyika Plateau, 6000–7000 feet" (B).

Synonymy. Laurent's (1947d, p. 293) remarkable discovery that the type of *flavomaculatus* is a juvenile *Leptopelis* and not an adult ♀ *Hyperolius*, as stated by its author, led me to compare the type of *flavomaculatus* with the type of *johnstoni*, also Günther's colored plate with a series of juvenile *johnstoni* from Magrotto Mountain. I have little doubt that Laurent is correct in suggesting they represent one species, and consequently *johnstoni* must be relegated to the synonymy, though Johnston's Tree-frog might well be retained as the English name, for *flavomaculatus* only describes the very juvenile coloring. I have taken it at Mwaya on the shore of Lake Nyasa, just north of Karonga, but did not succeed in getting any in Nyasaland in 1948, owing to the failure of the rains.

Hylambates maculatus Duméril

Hylambates maculatus A. Duméril, 1853, Ann. Sci. Nat. (3), **19**, p. 165, pl. vii, figs. 1–1b and 4: Zanzibar. Boulenger, 1882b, p. 134; 1891a, p. 308.

4 ♂♂, 1 ♀ (M.C.Z. 27203–7) Shire R. at Chikwawa. 18.iv.49.
2 ♀♀ (M.C.Z. 27208–9) Zambezi R. near Tete. 22.i.49.

Records. Shire Valley (B).

Native name of the Spotted Tree Frog. *Chula* (Nyungwe, *fide* John Simbi, which means that the Nyungwe have no special name for this distinctive black and scarlet frog).

Variation. Disk of longest finger two-thirds to three-quarters the diameter of tympanum; fingers without web; toes nearly half-webbed, only the two distal joints and disk of the longest toe being free; tibiotarsal articulation of the adpressed hind limb reaches the axilla or shoulder. Adult ♂♂ have a well-developed gular disk.

Size. Snout to anus of ♂♂, 60–62 (65 in a Brit. Mus. ♂) mm.; of ♀♀, 54–70 mm.

Habitat. The Shire series were ensconced in banana plants growing on the river bank; the subadults from the Zambezi were hiding beneath damp debris left by the receding river during the prolonged drought.

Kassina senegalensis (Duméril & Bibron)

Cystignathus Senegalensis Duméril & Bibron, 1841, Erpét. Gén., **8**, p. 418: Lakes in the vicinity of Galam, Senegal.

Cassina senegalensis Günther, 1894a (1893), p. 618; Johnston, 1897, p. 362; 1898, p. 361a; Mitchell, 1946, p. 30.

Kassina senegalensis ovamboensis Hoffman, 1942, Soölog. Navors. Nas. Mus. Bloemfontein, **1**, pp. 150, 154: Oshikango, Ovamboland, Southwest Africa.

Records. Zomba (Sir H. H. Johnston); Zomba Mtn. (J. R. Lennon), in British Museum (seen). I failed to get this distinctive species as it remains hidden in termitaria and other subterranean retreats until the onset of the monsoon rains, when it emerges for a relatively short time.

Synonymy. Though to the synonymy of *senegalensis*, Hoffman (1942, p. 152) added *descrticola* Ahl, 1930, of which M.C.Z. 17650 from Windhuk is a cotype, he then described *ovamboensis* as a race of *senegalensis*. Our series of *descrticola* suggests it may represent a large form, while our halfgrown paratype of *ovamboensis* does not have the tips of the fingers and toes swollen as alleged for the race. On page 150 the toes are said to be ¼ to ¾ webbed, whereas our paratype agrees with the figure of the type on page 154 in having no more web than in *senegalensis*. The other differences cited do not inspire confidence in the validity of *ovamboensis*, for some of those on page 150 conflict with those on page 155. *K. senegalensis* is genotype for *Kassina* Girard 1854, to which Laurent and Combaz (1950, p. 273) agree in referring the following as synonyms:

Tornierella Ahl, 1924
Cassiniopsis Monard, 1937
Semnodactylus Hoffman, 1939
Kassinula Laurent, 1940

Size. Snout to anus of the Brit. Mus. specimens: ♂, 33 mm.; ♀, 35 mm.

Afrixalus fornasinii fornasinii (Bianconi)

Euchnemis fornasinii Bianconi, 4.ii.1847 (republished iv.1849 in vol. for 1848), Spec. Zool. Mosamb., Rept., p. 23, pl. v, fig. 1: Mozambique.
Megalixalus fornasinii Boulenger, 1882b, p. 130; 1891a, p. 308; 1897e, p. 801; Johnston, 1898, p. 361a; Hoffman, 1944b, p. 179; Mitchell, 1946, p. 32.

4 ♂♂, 2 ♀♀ (M.C.Z. 27210–4) Mtimbuka. 23.ii.49.
8 ♂♂, 5 ♀♀ (M.C.Z. 27215–9) Kausi Village. 25.ii.49.
♀, 2 juv. (M.C.Z. 27220–2) Cholo Mtn. 16.iii.49.
3 ♀♀ (M.C.Z. 27223–5) Chikwawa. 18.iv.49.

Records. Chiromo (H); Karonga to Kondowe (B); Lake Nyasa (B); Monkey Bay (M. ms); Port Herald (M. ms); Shire Valley (B). I reject "Nyika Plateau, 6000–7000 ft." (B) for this lowland species.

Affinities. The genus *Afrixalus* was proposed by Laurent in 1944 for the African frogs previously referred to *Megalixalus*, now restricted to the single species *seychellensis*. Laurent's conclusions were confirmed by Guibé in 1948. Certainly the big insular *seychellensis* bears little superficial resemblance to the small continental frogs. Trinomials are employed as the West African *dorsalis* (Peters) is regarded as a race.

Variation. Tympanum concealed, though indications of its position may be detected in some ♀♀; fingers well webbed, the outer finger about half; second, third, and fifth toes webbed almost to, or to, the disk; tibio-tarsal articulation of the adpressed hind limb in both sexes, usually (in all 21 Brit. Mus. frogs) attains eye, occasionally falls short, still more rarely surpasses; dorsal skin of 21–24 mm. juveniles smooth, that of all (non-macerated) adults studded with black spines.

Size. Snout to anus of ♂♂, 29 to 34 mm., average 32 mm.; of ♀♀, 33 to 40 mm., average 34 mm. Twenty Brit. Mus. ♀♀ range from 27 to 35 mm. average 35 mm.

Breeding. Surely the froth nests to which Mitchell (1946, p. 32) refers are those of *Chiromantis*, with which he is also (p. 33) acquainted.

Habitat. Without exception all were taken in bananas as described by Mitchell.

Afrixalus brachycnemis brachycnemis (Boulenger)

Megalixalus brachycnemis Boulenger, 1896i, Ann. Mag. Nat. Hist. (6), **17**, p. 403, pl. xvii, fig. 2: Chiradzulu, Nyasaland. Boulenger, 1898b, p. 475; Noble, 1924, pp. 271, 332; Hoffman, 1944b, p. 180; Mitchell, 1946, p. 32.

Rappia fulvovittata Boulenger (not of Cope, 1860), 1897e, p. 801; Johnston, 1898, p. 361a.

Megalixalus fulvovittatus Pitman (not of Cope), 1934, p. 309.

Megalixalus orophilus Laurent, 1947a, Bull. Mus. roy. Hist. Nat. Belgique, **23**, No. 7, p. 1: Lac Magera, 2000 metres, eastern Belgian Congo.

Afrixalus orophilus Laurent, 1950e, Explor. Parc Nat. Albert, Fasc. 64, pp. 21–23, figs. 6–9.

♂ (M.C.Z. 27226) Chitala River. 17.xii.48.
3 ♀ ♀ (M.C.Z. 27227-8, 27250) Ruo River. 31.iii.49.
3 ♂ ♂, 7 ♀ ♀ (M.C.Z. 27229–34) Shire River. 18.iv.49.
♂ (M.C.Z. 27235) Zambezi River. 22.i.49.
♀ & juv. (M.C.Z. 27773–4) Limbe (exch. Mus. Nas. Bloemfontein).

Records. Cape Mclear (♀ in Brit. Mus.); Chiradzulu (B); Chiromo (M. ms.); Chitala (H); Limbe (as "Umbe": H); "Nyika Plateau" (error in loc.: as *fulvovittata:* (B).

Native name of Eastern Short-legged Banana-Frog. *Kachula kachena* (Nyungwe).

Synonymy. The 312 frogs of variable color pattern to which Laurent has given the name of *orophilus* and which, in the absence of morphological characters, he separates from *brachycnemis* on the grounds of habitat, are found in *Hagenia* and bamboo forest from about 3000 to 6000 feet. *A. brachycnemis* occurs chiefly in bananas at 4000 feet on Mlanje and in the Usambaras, down to 50 feet in the vicinity of Tanga. In western Tanganyika I have taken *brachycnemis* at Ujiji, so the supposed gap in distribution between *brachycnemis* and *orophilus* is probably to be attributed to nothing so much as the need for careful collecting by trained herpetologists *at the onset of the rainy season.* So tiny a frog is likely to be overlooked by the ordinary traveller and scorned by the average African.

Affinities. In suggesting that East African *brachycnemis,* as I understand it, is composed of several distinguishable races, Laurent (1947a, p. 3) is certainly mistaken. One can but suppose his material was very scanty for he postulates that typical Nyasaland and Uluguru frogs are distinguished by two parallel dorsal lines; that in Usambara frogs these lines fuse anteriorly; while the alleged coastal form is characterized by irregular and variable markings.

Actually from the Zambezi to north of the Tana, markings, if present, are subject to great variation. So much so that their assignment to any one of the four categories enumerated under the heading of color pattern (*vide infra*) is somewhat arbitrary. A well-defined and striking lateral band may be present on one flank and absent on the other, or continued behind the eye but no further than the shoulder. Similarly the dorsal lines on which Laurent relies, may be developed anteriorly but not posteriorly, vice versa, or coalesced at various points if not altogether lacking as is most commonly the case. But in none of our seven Usambara frogs do the dorsal lines coalesce anteriorly as they presumably do in some individuals seen by Laurent.

Color pattern in East African *b. brachycnemis* from S. to N.

M.C.Z. Nos.	*Localities*	*No lateral or dorsal lines*	*A broad lateral band*	*A lateral band and 2 dorsal lines*	*No lateral band but 2 dorsal lines*
27235	Zambezi R., M.	1			
27229–34	Shire R., N.	3	2	3	
27227–8; –50	Ruo R., N.	2			1
27773–4	Limbe, N.			2	
27226	Chitala R., N.			1	
16837–46	Mwaya, L. Nyasa	216	24	26	11
16847	Mwandemeres, T.	1			
25161–2	Ruvuma R., T.	48	13	11	1
26635	Liwale, T.			1	
25163–4	Mikindani, T.			1	1
9524–5	Dutumi, T.	2			
13336–7	Uluguru Mtns., T.				2
13338–46	Tawa, T.	8			1
9528–9; 16805	Morogoro, T.	6			3
16849–50	Ujiji, T.			1	1
13347–56	Dar es Salaam, T.	4	2	4	
16826–36	Mwera, Z.	20	6	5	2
10196–7	Mkokotoni, Z.		1	1	
13357–60	Usambara Mtns., T.	7		3	4
25169–70	Magrotto Mtn., T.	2	1		2
25165–6	Siga Caves, T.	2			
25167–8	Amboni, Tanga, T.	32	2		
20595	Changamwe, K.C.		1		
20590–4	Golbanti, K.C.	2	6	2	
20585–9	Witu, K.C.	8	2		
20581–4	Peccatoni, K.C.	3	2	6	

Laurent did not propose names for these as Ahl (1931b, pp. 22–122) had done so previously (*ipianae* from Ipiana near Mwaya; *unicolor*

from Ipiana; *multifasciatus* from Rungwe; and *pygmaeus* from Tanga). Ahl placed all four in the genus *Hyperolius* from which I (1933h, p. 399) transferred them to the synonymy of *brachycnemis*. Lest anyone is tempted to revive them subspecifically — because the uniform frogs are strikingly different in appearance from those with sharply defined lateral bands and dorsal lines, though every intergradation occurs — it seems advisable to publish below the data on which my conclusions were based. Trinomials are used because of the existence of a West African race.

Variation. Tympanum concealed; fingers indistinctly webbed at base; second and third toes usually three-quarters webbed, fifth usually (almost in three cotypes) to the disk; tibio-tarsal articulation of the adpressed hind limb reaches to the shoulder or just beyond, but not so far as the eye.

Color. All three cotypes (B.M. 1947.2.9.77–79) have two reddish brown dorsal lines and a lateral band.

Size. Snout to anus of ♂♂, 17 to 21 mm.; of ♀♀ (among which may be included some immature ♂♂), 20 to 27 mm. (M.C.Z. 27250), apparently the record for this species.

Habitat. All taken in bananas on river banks, their scarcity in three localities being due to prolonged drought.

Hyperolius marginatus Peters

Hyperolius marginatus Peters, 1854, Sitzb. Akad. Wiss. Berlin, p. 627: Maçanga, Mozambique.

10 ♂♂, 17 ♀♀, 3 imm. (M.C.Z. 27280–9) Nyika Plateau. 1–19.xi.51.
♂ (A.M.N.H. 53248) Nyika Plateau. viii.46.

Records. New to Nyasaland.

Affinities. These frogs are unquestionably conspecific with the 227 which I (1933h, p. 406) collected in the Uzungwe, Ukinga, Poroto, and Rungwe Mountains just north of the Nyika in Tanganyika Territory. I immediately recognized them as the same in the field, before their diversified coloring had been masked by formalin preservation. As previously (p. 407) stated, we cannot be sure that these frogs are actually *marginatus* until we have topotypes from Maçanga, which I assume to be Makanga on the Aca River west of the Kirk Range and approximately at a point due west of Zomba and due north of Tete. Having secured numerous topotypes of *ngoriensis* Ahl, and *pictus* Ahl (part) I am still confident they are synonyms, and suspect that his *nyassae* is also *in part*, for our paratype *nyassae* (M.C.Z. 17642)

from Rungwe Mtn. is definitely an *undulatus* Boulenger. When it can be demonstrated beyond question that these frogs are really *marginatus* then *picturatus* Peters had best be treated as a race.

The only person to record fresh *marginatus* since 1933 is Mertens (1940a, p. 249) who had a ♂ and two ♀♀ from Ugano, Matengo Highlands, just across the lake from the Nyika Plateau where they occur at 7000 feet.

Variation. Distance from end of snout to nostril about half that between nostril and eye; outer finger with terminal phalanx and disk free of web; fourth toe, at least on one side, with almost two phalanges and disk free of web, the remaining toes with one phalanx and disk only; tibio-tarsal articulation of adpressed hind limb (in both sexes) attains the shoulder or (more rarely) eye; skin smooth above and on throat, the gular disks of ♂♂ being rarely more than subgranular (? preservation); breast and belly granular.

Color. The 16 mm. juvenile's only marking is a faint trace of a canthal-lateral stripe resembling that of *punctiulatus*, present in two of the adults. The latter exhibit the characteristically variable marbling and vermiculations on the flanks so well shown in the five drawings of *pictus* Ahl (1931c, p. 302, fig. 176).

In view of the fugitive nature of the pattern in this species it seems advisable to record some of the diverse types noted in life.

♂. Above, yellowish green; from upper eyelid to insertion of thigh a pair of discontinuous dorso-lateral stripes; from nostril to halfway along flank extends a lateral band except where interrupted by an irregular, dark-edged, yellow streak from below eye to angle of mouth and another that slopes from the tympanic region towards the forelimb; forelimb with several large, dark-edged, yellow spots, a similar spot on flank behind axilla followed by a horizontal yellow streak; along the outer (exposed) part of the hind limb is a brownish band comprised of fine stippling with some irregular, paired, yellow spots, with or without black edging, on thigh and foot. Below, gular disk lemon yellow; rest of throat and belly cream-colored; limbs an almost transparent orange tinged with red towards palms and toes.

Another ♂ has a yellow-green band extending from tip of snout over upper eyelid almost to the groin, in its posterior portion this band is speckled with black; back exhibits some irregular yellow spotting that forms a vertebral streak from region of urostyle to above the anus, otherwise back and flanks uniform with limbs, which are less spotted than in the ♂ described above.

A third ♂ is almost uniformly brown above except for an obsolescent streak just discernible between eyelid and insertion of hind limb; posteriorly this streak is clear yellow on the right side only; the amount of spotting on limbs is even less than in the other two.

♀ adult (M.C.Z. 27286) of 38 mm. Above, reddish brown; from the nostril through eye to above forearm is a dark brown streak, flank brownish with a series of coalescing, dark-edged, vivid yellow spots, two others above anus and half-a-dozen more on thigh and foot. Below, chrome yellow, the limbs colored like those of the first ♂ described above.

♀ imm. of 28 mm. Above, uniform pinkish brown with obsolescent dorso-lateral streak but no trace of yellow spots.

Size. Snout to anus of ♂♂, 24–29 mm., average 28 mm.; of adult ♀♀, 31–38 mm., average 34.3 mm. In addition there are two immature ♀♀ of 28 mm. and a juvenile of 16 mm.

Breeding. During November the adult ♀♀ were obviously ready to spawn. Both they and the males were taken on the senecio-like plants growing in the marshy hollows (*dambo*).

Hyperolius marmoratus albofasciatus Hoffman

Rappia marmorata Günther (not of Rapp), 1895, p. 526: Boulenger 1897e, p. 801; Johnston, 1898, p. 361a.

Hyperolius albofasciatus A. C. Hoffman, 1944b, Soolog. Navors, Nas. Mus. Bloemfontein, p. 178, fig. 8: "Umbe," i.e. Limbe, Nyasaland. Mitchell, 1946, p. 32.

Hyperolius cinctiventris Hoffman (part; not of Cope), 1944b, p. 178: "Umbe" specimens (one is now M.C.Z. 27775).

Hyperolius horstokii Mitchell (not of Rapp), 1946, p. 32.

Hyperolius symetricus Mitchell (not of Mocquard), 1946, p. 32.

♂ ♀ (M.C.Z. 27236–7) Mtimbuka. 9.ii.49.
16 + 7 ♂♂ (M.C.Z. 27244–9, 27300–5) Ruo R. 2.iv.49.
13 + 6 ♂♂, 1 ♀, 5 juv. (M.C.Z. 27238–43, 27290–9) Limbe. 16.iv.49.
♂ (M.C.Z. 27775) Limbe (Exch. Nas. Mus. Bloemfontein).

Records. Fort Johnston (H. H. Johnston & P. Rendall, in Brit. Mus.); Karonga to Kondowe (as *marmoratus:* B); Mandala, Blantyre (as *marmoratus:* G); Monkey Bay (C. Christy, in Brit. Mus.); Mpingwe Hill, Limbe (as *horstokii:* M); Limbe (as *albofasciatus* and *cinctiventris:* H); Zomba (J. S. Old & A. Sharpe, in Brit. Mus.); Zomba Mtn. (as *horstokii* and *symetricus:* M).

Mr. B. L. Mitchell, who collected the material reported on by Hoffman, took me to the precise spot on Mpingwe Hill, Limbe, where he took the holotype of *albofasciatus*. However, owing to the prevailing drought the stream was nearly dry, so he drove me to the nearest pond where we gathered the series of topotypes. Mitchell told me he had also taken the species at Cholo, and considered the dichromatic frogs represented a single species; though at the time I was inclined to disagree with him I have little doubt that he is correct.

Native names of White or White-striped Sedge-frog. *Kilowero* (Nyanja) *zonde* (Chewa), but both are probably generic.

Affinities. There can be little doubt that we are dealing with a species in which one third of the ♂♂ (indicated above by the figures 13 + 6 and 16 + 7) are uniformly colored while the remainder exhibit a striking pattern as figured by Hoffman. This pattern is faint in a few individuals, but none can be considered as representing an intermediate condition between the majority and the immaculate putty-colored minority. In our extensive topotypic series of *m. marmoratus* Rapp are similar immaculate putty-colored specimens which neither my colleague Mr. Benjamin Shreve, nor I, can distinguish from these Nyasaland ♂♂.

In a short series of frogs (M.C.Z. 26313–5) from Kisantu, Belgian Congo, identified as *parallelus* by Laurent, the ♂ is immaculate putty-color while the 32 mm. ♀♀ differ but slightly from *albofasciatus*. In these frogs, as also in at least two of the cotypes of *parallelus* Günther and two (B.M. 97.1.30.12–13) from Zambi, Lower Congo, the dorso-lateral white line is anteriorly separated from the white underside by a more or less well-defined black line. In *albofasciatus* this black line is either entirely absent or at most represented by a series of scattered spots or dashes. However, in this character a frog (B.M. 01.3.12.17) from Kakonga, Lower Congo agrees better with *albofasciatus* and I am not in a position to say whether such a condition occurs commonly among western *parallelus;* if it does, then *albofasciatus* will eventually have to be synonymized with *parallelus* which I regard as a race of *marmoratus*.

Günther (1858b, p. 86) states that his three cotypes of *parallelus* came from "South Africa" and "Angola" respectively, later altered or amplified by Boulenger (1882b, p. 122) as ♀ from "Cape of Good Hope," and ♀ with hgr. from "Ambris, Angola." Unfortunately these last two frogs are badly macerated and Günther figured the "South

African" frog, otherwise one would have been tempted to restrict the type locality to Ambriz, which is 70 miles north of Loanda, which is 260 miles north of Benguela, all three places being on the coast of Angola from which region I have no doubt that the "South African" frog also came.

From Benguela, Bocage, 1868 (1867) described *H. insignis*, apparently based on a ♀ as its throat was smooth and its length 37 mm., and from Loanda, Bocage, 1868 (1867) described *toulsonii*, probably a ♂ for its throat was granular and its length only 26 mm. As I find nothing in the figures of descriptions of these two frogs to suggest they are racially distinguishable from *parallelus*, I consider them to be synonyms of that race of *marmoratus*.

Similarly I regard *melanoleucus* Laurent as another race of *marmoratus*[1] and consider Laurent (1947d, p. 290, footnote) mistaken in saying that *melanoleucus* is indistinguishable from adult *nyassae* Ahl, by which I presume he means what is here called *m. albofasciatus*. Though very similar, I have no difficulty in separating topotypic patterned *albofasciatus* ♂♂ from topotypic patterned *melanoleucus* ♂♂; whether uniform individuals of both races are separable is not so sure.

Laurent (1947d, p. 290, footnote) is wrong in supposing that the type of *nyassae* Ahl was a juvenile, for Ahl gives its length as 31 mm., and sent us a cotype ♂ (M.C.Z. 17642) from Rungwe Mtn. of 29 mm. This bleached ♂ retains the interocular and lateral markings characteristic of the figured type of *undulatus* Boulenger, with which I (1936k, p. 395) synonymized it.

However, Laurent (1943a, p. 108) after examining the types of *undulatus* and *rhodoscelis* Boulenger, both from Pweto, finds that they are really the immature and adult of a single species — *rhodoscelis*. My past references to *undulatus* should, together with its numerous synonyms, therefore be transferred to *rhodoscelis*.

The Nyamkolo frogs that I called "*rhodoscelis*" are referable to *kivuensis* Ahl, as Laurent (1947d, p. 291) discovered and pointed out, but he is incorrect in saying that my topotypic *kivuensis* are *viridiflavus kwidjwiensis* Ahl — except in so far as *kwidjwiensis* is a synonym of *kivuensis* as I (1942f, p. 400) have said. In other words my Idjwi Island *kivuensis* are indistinguishable from the Nyamkolo frogs except that the throats of the latter are lighter, though a few of them exhibit traces of dark speckling.

[1] As does Laurent in a 1951 paper which unfortunately only reached me after this report had gone to press.

Variation. Distance from end of snout to nostril rather more than half that between nostril and eye; outer finger with terminal phalanx and disk free of web (i.e. half-webbed, and *not* "entirely free of webbing" as stated by Hoffman); toes webbed to the disk (at least on one side) except the fourth (and occasionally the first and fifth) which may have part of the terminal phalanx free of web; tibio-tarsal articulation of the adpressed hind limb attains the eye or nostril in ♂♂ (inc. nine in Brit. Mus.), the eye in all three ♀♀ (inc. eight in Brit. Mus.); skin smooth above, also on throat and chest of ♀♀ (except for two at Brit. Mus.), the gular disks of ♂♂ subgranular (? preservation); bellies of all granular.

3 ♂♂, 3 juv. (B.M. 1928.2.20.18–23) Zomba Mtn.

The various names employed by Mitchell for Zomba material result from his having submitted it to various herpetologists with differing views, also from the fact that the juvenile coloring (*symetricus* was based on a juvenile of the *marmoratus* group) bears little or no resemblance to that of the adult. While the British Museum series listed above undoubtedly represents a single form, one ♂ has clearly got more webbing than other members of the series, as I found in my own Nyasaland material. One of the young has a faint dark lateral band, otherwise the coloring is whitish to grayish or a faint brownish putty.

Color of typical *albofasciatus* only. Above, black (in alcohol), rarely gray brown (in formalin); from snout to anus a narrow or moderately broad, usually straight though sometimes wavy (2 ex.) or even interrupted (M.C.Z. 27240), conspicuous white vertebral line; a similarly colored but ill-defined white lateral line from eye to anus, ill-defined because there is often nothing to separate it from the white belly, at most an obsolescent series of dusky spots (representing the black lateral line of the typical form); sometimes also a lateral series of small orange spots extending anteriorly on to upper lip; forelimb white, usually spotted or streaked with black in ♂♂, minutely dusted with brown in ♀♀; thighs colorless (flesh-pink in life); tibia and outer aspect of hind feet white, spotted, streaked, or vermiculated with black, but highly variable and sometimes almost black with white spots. Below, throat uniform white (M.C.Z. 27737) or minutely stippled and dusted with black, ♂♂ display two dark patches, one on either side of the gular disk; rest of undersurface white (thighs, hands and feet flesh-pink to red in life).

Size. Snout to anus of ♂♂, 26–32, average 30 mm.; of ♀♀, 34–35 mm. Both ♂♂ and ♀♀ of topotypic *marmoratus* average slightly smaller.

Breeding. Both ♀♀ were gravid; the Ruo River ♂♂ were captured at night while calling from grass or sedges in a swamp near Lujeri River. The Limbe ♂♂ were taken in daylight as they squatted on sedges standing in water.

Habitat. The Mtimbuka ♂ was found squatting sideways in a hole into which it just fitted; the cavity was in the bark on the vertical trunk of a baobab and situated at a height of about six feet from the ground.

Hyperolius concolor tuberilinguis Smith

Hyperolius tuberilinguis A. Smith, 1849, Illus. Zool. S. Africa, Rept., App., p. 26: country eastward of Cape Colony.

Hyperolius citrinus Günther (part), 1864d, Proc. Zool. Soc. London, p. 311, pl. xxvii, fig. 2: "Zambesi Expedition" (restricted to), and "Senegal" (rejected as typical *concolor*).

Rappia concolor Boulenger (not of Hallowell), 1882b, p. 124; 1891a, p. 308.

Rappia cinctiventris Günther (not of Cope), 1894a (1893), p. 619; Johnston, 1897, p. 362; 1898, p. 361a; Hoffman (part, i.e. Chiromo and Chitala), 1944b, p. 178.

Hyperolius kivuensis smaragdinus Laurent, 1947d, Ann. Mag. Nat. Hist. (11), **14**, p. 292: ♀ holotype from Charre, Mozambique (paratypes consist of 7 ♀♀ and 1 ♂ from Charre; Caia; Quelimane and "Zambesi Expedition.")

Hyperolius sansibaricus loveridgei Laurent, 1947d, Ann. Mag. Nat. Hist. (11), **14**, p. 294: ♀ holotype from Kitaya, Ruvuma River, Tanganyika Territory (paratypes consist of 120 ♂♂ and 13 ♀♀ from Kitaya previously referred to *c. citrinus* Günther by Loveridge).

imm. ♂, juv. (A.M.N.H. 53818–9) Chibotela. 28.viii–18.ix.46.

3 ♂♂ (M.C.Z. 27275–7) Lake Nyasa at Mtimbuka. 23.ii.49.
♀ (M.C.Z. 27278) Shire River at Chikwawa. 18.iv.49.

Records. Chiromo (adult[1] as *cinctiventris:* H); Chitala (as *cinctiventris:* H); Shire Valley (as *concolor:* B). The specimen listed by Günther as from "British Central Africa," having been "transmitted by Mr. H. H. Johnston," appears in the British Museum catalogue as from Zomba (where Johnston resided), but was more probably brought back by Whyte (see p. 618) from Fort Johnston, 14 miles from Mtimbuka, together with the endemic lake fish which certainly never came from Zomba.

[1] But not seen by me, so open to question.

Synonymy. Some years ago I pointed out (1941c, p. 287) that topotypes of *tuberilinguis* A. Smith from Natal, could not be distinguished from Liberian topotypes of *concolor* Hallowell (1844) though 4000 miles apart. In view of the interest now being shown in this difficult genus it appears advisable to emphasize this statement by making *tuberilinguis* a subspecies of *concolor.*

Günther's *citrinus* was a composite for his cotypes came from Senegal (*concolor*) and the "Zambesi Expedition" (restricted to *citrinus*). Günther may have been right when he (1894a) synonymized *citrinus* with *cinctiventris* Cope, though I (1941c, p. 285) do not think so after seeing the alleged type of *cinctiventris* preserved in the Academy of Natural Sciences of Philadelphia.

I have compared the other frogs from the "Zambesi Expedition," Quelimane, and Shire Valley, that Boulenger (1882b) referred to *concolor*, and Laurent more recently (1947d) designated paratypes of his *kivuensis smaragdinus*, and find them specifically indistinguishable from the green ♀ (M.C.Z. 27278) from the Shire River. As it and the straw-colored ♂♂ from Mtimbuka are also indistinguishable from frogs of their respective sexes in our topotypes of *tuberilinguis*, I synonymize *smaragdinus* with that form.

Regarding the "Zambesi Expedition" cotype to which I (1942f, p. 407) proposed restricting the name of *citrinus*, suggesting the specimen might have been taken at Rovuma Bay (near Kitaya) when the Zambesi Expedition stayed there, Laurent (1947d, p. 293) states that the frog "is a juvenile of the *marmoratus* group, but with indistinguishable pattern," yet on page 288, he states that members of the *marmoratus* group are characterized by their juvenile colour-pattern." It is somewhat difficult, therefore, to see the justification for Laurent's alternative suggestion to synonymize *citrinus* with *taeniatus* Peters, 1874, of which the type was a strongly striped, 20 mm. juvenile from Boror on the Zambezi River.

I prefer to regard the extensive Kitaya series as representing *citrinus* Günther, which I am now synonymizing with *tuberilinguis* Smith as neither I nor my colleague Mr. Benjamin Shreve, can detect either color or morphological differences by which they may be separated. In any event as the type series of *s. loveridgei* Laurent, they cannot be distinguished from *tuberilinguis.*

Variation. Distance from end of snout to nostril rather more than half that between nostril and eye; outer finger with terminal phalanx and disk free of web; as also the first and fourth toes though in some

a very narrow seam of web may extend to the disk; the remaining toes are webbed almost to the disks; tibio-tarsal articulation of the adpressed hind limb (in both sexes) attains the eye, or beyond (juv.); skin smooth above as also on throat and chest of ♀; gular disks and chests of ♂♂ granular like all bellies. The foregoing applies also to the holotype and all the paratypes of *Hyperolius kivuensis smaragdinus* at the British Museum, each having been checked individually.

Color. In life the Mtimbuka ♂♂ were straw or putty color, in alcohol whitish to pale brownish with a darker, light-edged above, indistinct canthal streak; in life the ♀ was a vivid green, in alcohol solidly blue-black except on the thighs.

The immature ♂ from Chibotela differs but little. Above, brown, darkening along its lower edge to form an ill-defined darker band from tip of snout to, and along, flank. Definitely not *m. albofasciatus.*

I can only assume that the juvenile is the same species. It displays much of the "*undulatus*" pattern, viz. on its crown a subcircular mark formed of a light semicircular line anterior to, and a second posterior to, and connecting with, the eyelids; a faint, light, cantho-dorsolateral line giving off the characteristic light-edged blotch in front of the groin (as figured by Ahl for *nyassae*); limbs showing the usual dark and light disruptive pattern of young "*undulatus*". See remarks on status of *undulatus* under affinities of *m. albofasciatus.*

Size. Snout to anus of juvenile, 17 mm.; of imm. ♂, 27 mm.; of Mtimbuka ♂♂, 33–36 mm.; of ♀, 39 mm.; i.e. 1 mm. larger than any of the 16 Tanganyika ♀♀ listed in my (1942f, p. 409) series, 3 mm. larger than the type of *tuberilinguis* A. Smith, and 8 mm. larger than the Shire River paratype ♀ (B.M. 47.2.25.40) of *K. smaragdinus* Laurent, but identical in length with the holotype and four other paratypes.

Habitat. The ♂♂, which were emitting an explosive snap-like call similar to that recorded for my Kitaya *citrinus,* were found with the help of a flashlight as they squatted on rain-drenched palm fronds or on the herbage growing among fallen fronds lying in grassland close to the lakeshore. The ♀ was reached by boat, for she was clinging to a sedge growing out of the swirling waters of the Shire River.

Hyperolius argus argus Peters

Hyperolius argus Peters, 1854, Ber. Akad. Wiss. Berlin, p. 628: Boror, Mozambique (based on ♀). Mitchell, 1946, p. 32.

Hyperolius flavoviridis Peters, 1854, Ber. Akad. Wiss. Berlin, p. 628: Boror, Mozambique (based on ♂).

Hyperolius fulvoviridis Mitchell (lapsus for *flavoviridis*), 1946, Nyasaland Agric. Quart. Journ., 6, p. 31: Chiromo, Nyasaland.

♀, juv. (M.C.Z. 27044–5) Chiromo (Zool. Soc. London).

Records. As Boulenger's (1897e, p. 801) record of "*argus*" from the "Nyika Plateau, 6000–7000 ft." was based on misidentified *p. punctic-ulatus* (which see) that probably never came from the Plateau, and Johnston's (1898, p. 361a) listing was based on Boulenger, Mitchell is the first person to record this frog from Nyasaland. Mitchell collected this lowland species just where one might expect to find it — along the Lower Shire. The record was based on living frogs seen in the London Zoological Gardens by Parker. No one, however, knows this frog better, for it was Parker (1931a, p. 902, col. pl. i) who first traced the transitional stages in the development of the color pattern, which differs so strikingly between young and adult, ♂ and ♀. Fortunately, after their decease, two of Mitchell's frogs were preserved by the Zoological Society to whom we are indebted for the specimens listed above.

Synonymy. Though Mitchell tells me he had no intention of designating a new species when he published the name *fulvoviridis,* it is apparently validated by his description of it as "a lovely grass green speckled above with tiny dark dots." He further states that some of these frogs can always be found in the tops of the *Ageratum* on the river bank within twenty yards of the rest house at Chiromo.

English name. Argus-eyed Sedge-Frog.

Variation. Distance from end of snout to nostril rather more than half that between nostril and eye; outer finger with terminal phalanx and disk free of web; as also the first and fourth toes, the remaining toes webbed to the disk on one side; tibio-tarsal articulation of the adpressed hind limb attains the forward part of the eye (adult) or just beyond (juv.); skin smooth above and below (as no adult ♂).

Color. Above, pinkish brown, a light, dusky-edged Π-shaped mark on snout from nostril around eye and, after a brief interruption, continued on the right side for rather more than halfway along flank; on the left side three very irregular, light, dark-edged blotches and a fifth on the dorsum.

Juvenile. Pale gray with Λ-shaped mark on snout and two unequal azygous, light, dark-edged spots on dorsum.

Size. Snout to anus of ♀, 30 mm.; of juv., 22 mm.

Hyperolius puncticulatus puncticulatus (Pfeffer)

Rappia puncticulata Pfeffer, 1893 (1892), Jahrb. Hamburg. Wiss. Anst., **10**, p. 31, pl. ii, fig. 2: Zanzibar.
Rappia argus Boulenger (not of Peters), 1897e, p. 801; Johnston, 1898, p. 361a.

♀ (M.C.Z. 3227) "Nyika Plateau." A. Whyte (Exch. Brit. Mus).
♂, 4 ♀♀, 11 juv. (M.C.Z. 27251–63) Misuku Mtns. 23.ix–4.x.48.
juv. (M.C.Z. 27264) Nchenachena. 20.xi.48.
♂ (M.C.Z. 27265) Likabula River. 4.viii.48.
16 ♂♂ (M.C.Z. 27266–9) Ruo River. 1–2.iv.49.

Records. B.M. 97.6.9.198 and M.C.Z. 3227, are undoubted *puncticulatus*. The latter is one of the two frogs from the "Nyika Plateau, 6000–7000 ft." assigned to "*argus*" by Boulenger. I very much doubt if this species occurs as high as stated, though I found it on the slopes of the Nyika at Nchenachena at 4200 ft. but not on the plateau itself where we spent three weeks.

Native name. Koti (Misuku).

Affinities. Accumulating material of *puncticulatus* appears to indicate a northern (*substriatus* Ahl) and southern (typical *puncticulatus*) race meeting on a line drawn from Morogoro to Zanzibar; in Nyasaland are two additional races (described below).

The northern form is well depicted in Ahl's figures of *substriatus*, an exceedingly variable race characterized (typically) by a *broad*, yellow, black-edged canthal band that may be reduced to a nasal spot though more usually is prolonged beyond the eyelid and frequently along the flanks, in which event it tends to become even broader and very liable to disintegrate, sometimes quite fantastically. We have this race (*p. substriatus*) from Malindi, Kenya Colony; the Usambara Mtns. (at Bumbuli; Derema; Phillipshof); Magrotto Mtn. (a cotype and many topotypes); Amboni Estate near Tanga; Kilosa; Morogoro (at foot of Uluguru Mtns.); and Mwera, Zanzibar Id.

The southern form apparently agrees with Pfeffer's not too distinct figure of *puncticulatus* from Zanzibar (Procter's, 1920, fig. of *Rappia puncticulata* really represents *p. substriatus*). Typical *puncticulatus* differs from all other races in its *narrow*, yellow, black-edged, canthal band that passes over the eye and may continue to halfway along the flank, or terminate in tympanic region in which event it is apt to continue as a series of disconnected yellow, black-edged dashes or dots. We have this race (*p. puncticulatus*) from Morogoro (though the specimens may well have come from up the Uluguru); the Uluguru

Mtns. (at Bagilo; Nyingwa; Vituri); Ilolo (at foot of Rungwe Mtn.); and the Nyasaland localities listed above.

Variation. Distance from end of snout to nostril rather more than half that between nostril and eye; outer finger with terminal phalanx and disk free of web; as also the first and fourth toes, the remaining toes webbed to the disk on one side (at least in specimens over 17 mm.); tibio-tarsal articulation of the adpressed hind limb barely attains, attains, or just passes the eye; skin smooth above, also on throat of ♀ ♀• and chest; gular disks of ♂♂ strongly granular as are the bellies, except in young under 16 mm. and in a ♂ (M.C.Z. 27261), though occasionally masked by preservation.

Color. Above, pinkish brown, typically from snout over eyelid to flank a pair of parallel black lines enclosing a narrow yellow (fades on preservation) band that on the flank may, or may not, break up into a series of irregular, yellow, black-edged, blotches (this highly characteristic marking occasionally disappears except immediately in front of, and behind, the eye, where a trace of it may always be detected with a lens); back and limbs usually uniform, sometimes with dusky speckling. While this dusky speckling and Ω-shaped marking on snout appear to be a survival of juvenile pattern, this is not the case with the continuation of the canthal stripe on the flanks, for it is absent in the young.

Size. Snout to anus of ♂♂, 25–35, average 28 mm.; of ♀ ♀, 32–43 mm.; of juveniles and immature frogs from 14 mm. with rudiment of tail (M.C.Z. 27264) up to 29 mm., a very good developmental series.

Breeding. The Ruo River ♂♂ were captured at night while calling from grass and sedges in a swamp near Lujeri River.

Enemies One was recovered from the stomach of a *Crotaphopeltis h. tornieri.*

Habitat. The Misuku series were taken in wild bananas in Matipa Forest with the exception of the largest ♀ which was on the bank of a small stream, where it may have fallen from vegetation during the cutting of a path.

Hyperolius puncticulatus cholоensis subsp. nov.

Text figure 1

Type. M.C.Z. No. 27270, a spent ♀ from Cholo Mountain, at about 3500 ft., Nyasaland. Collected by Arthur Loveridge, March 21–26, 1949.

Paratype. M.C.Z. No. 27271, an adult ♂ taken at same time and place as the holotype. British Museum, No. 47.1.3.78, an adult ♀ from Konjeni, 10 miles below Luchenza, Cholo District. Collected by B. L. Mitchell for the Zoological Society of London.

Diagnosis. A race resembling *H. p. substriatus* Ahl (see remarks concerning affinities under typical *puncticulatus*) in its broad, white (at least in alcohol; I omitted to note its color in life), black bordered, cantho-dorso-lateral stripe which is continued posteriorly two-thirds of the way towards the groin. The ♂ bears a single round, white, black-edged spot on the parietal region, the ♀ two, but lacking the black border, and a series of four more (one behind the other) between region of urostyle and anus; of these the last three are black-edged; limbs buffy brown like the dorsum, immaculate. There are neither parietal nor dorsal spots in the paratype collected by Mitchell.

Description. Substantially as given for typical form, but in the ♂ paratype (possibly due to dessication during life) the webbing is a trifle less extensive than in the holotype; tibio-tarsal articulation of the adpressed hind limb barely attains the eye in both; throat and chest of ♀ ♀ smooth; large gular disk of ♂ granular like bellies and, to some extent, the thighs in both sexes.

Size. Snout to anus of paratype ♂, 32 mm.; of holotype and paratype ♀ ♀, 40 mm.

Hyperolius puncticulatus mitchelli subsp. nov

Text figure 2

Type. M.C.Z., No. 27272, a gravid ♀ from a banana grove almost on shore of Lake Nyasa a few miles north of Mtimbuka, which is 14 miles north of Fort Johnston, Nyasaland. Collected by Arthur Loveridge, February 23, 1949.

Paratypes. M.C.Z., Nos. 27273–4, an adult ♂ and a juvenile taken at same time and place as the holotype.

Diagnosis. A race slightly resembling *H. p. substriatus* Ahl (see remarks concerning affinities under typical *puncticulatus*) in its broad, white (in life also, if I remember rightly), black-bordered, cantho-dorso-lateral stripe which is continued posteriorly two-thirds of the way towards the groin; the very conspicuous black spots on head, back, arms, femur, and outer side of foot in the type, are lacking in the paratypes.

Description. Substantially similar to that given for the typical form

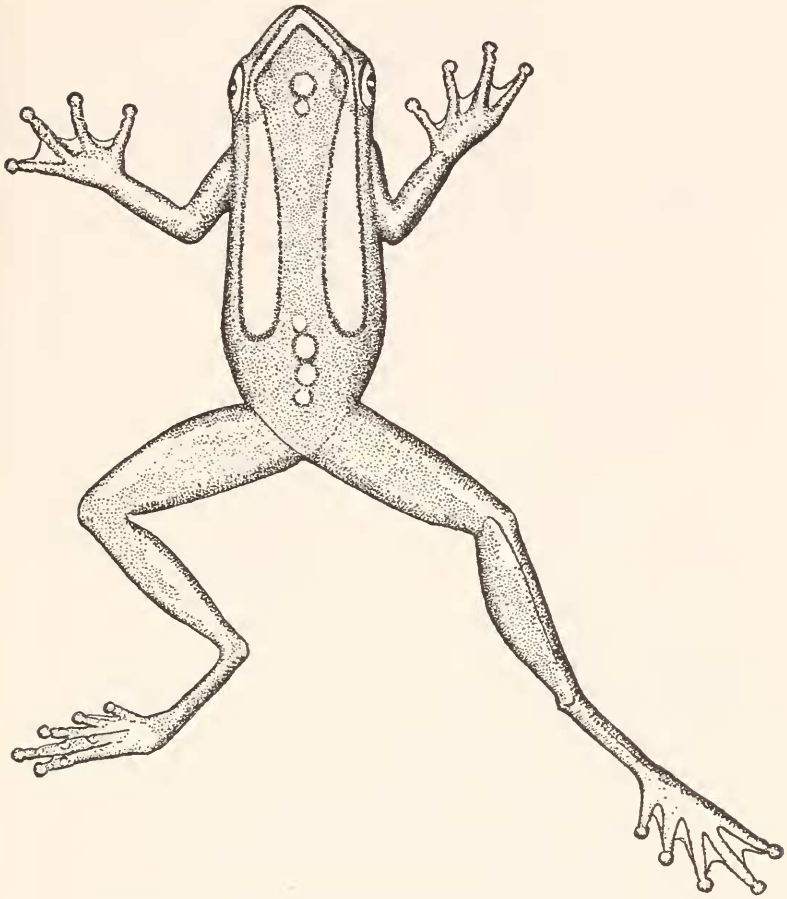

Fig. 1. *Hyperolius puncticulatus choloensis* (Type ♀ M.C.Z. 27270).

though in the type of *mitchelli* the distance from end of snout to nostril is exactly (in paratypes, "rather more than") half that between nostril and eye; outer finger with terminal phalanx and disk free of web; as also the first and fourth toes, in the type the remaining toes are clearly, though not fully, webbed to the disk on one side, but in the paratypes there is half a joint free; in all three frogs the tibiotarsal articulation of the adpressed hind limb barely attains the eye;

Fig. 2. *Hyperolius puncticulatus mitchelli* (Type ♀ M.C.Z. 27272).

throat and chest of ♀ smooth; large gular disk of ♂ granular like bellies and thighs of both sexes.

Size. Snout to anus of paratype ♂, 25 mm.; of holotype ♀, 31 mm.; of juvenile, 21 mm.

Hyperolius nasutus Günther

Hyperolius nasutus Günther, 1864c, Proc. Zool. Soc. London, p. 482, pl. xxxiii, fig. 3: Duque de Bragança, Angola.

Rappia nasuta Günther, 1894a (1893), pp. 619, 620; Bocage, 1896a, p. 104.

Rappia vasata (*sic:* m sprint) Johnston, 1897, p. 362; 1898, p. 361a.

Rappia granulata Boulenger, 1901g, Ann. Mus. Congo (1), **2**, fasc. 1, p. 4,

pl. ii, fig. 3: Pweto, Lake Mweru, Belgian Congo.
Rappia oxyrhynchus Boulenger, 1901g, Ann. Mus. Congo (1), **2**, fasc. 1, p. 5, pl. ii, fig. 4: Pweto and Lofoi, Belgian Congo.
Hyperolius acuticeps Ahl, 1931c, Das Tierreich, no. 55, p. 282, fig. 153: Ukonde-Unyika, southwestern Tanganyika Territory.

♂ (A.M.N.H. 53299) Chibotela. 28.viii–18.ix.46.
8 juv. (M.C.Z. 27500) Nchisi Mtn. 27.xii.48.
The identification of these last, seven being tailed tadpoles, is open to question.

Records. Nyasa (G., p. 621, by which he undoubtedly meant the Lake as the country was then known as British Central Africa. The frog probably came with the fish from Fort Johnston, though listed in the B.M. register as from Zomba. This was where Whyte and Johnston lived and presumably the place from which the whole shipment was dispatched). Chibotela is about three miles west of the Lake at an altitude *ca.* 1700 ft.

Affinities. Of his "well-preserved example in the Nyasa collection" Günther wrote that "there cannot be any doubt about its identity with" *nasuta* of Angola. Recently Dr. R. Laurent (1943a, p. 74) revived *granulatus* from the synonymy of *nasutus* and recognized *oxyrhynchus* as well. Both of Boulenger's species were described from Pweto and Laurent records both, as well as *nasutus*, from Elisabethville, and *nasutus* with *oxyrhynchus* at Kando; Kasenga; Lukafu; and both from Muita, Luembe, Angola. I am indebted to him for sending me representative series of the two alleged species from several localities. In both "species" the silvery white lateral band may be present or absent. Among the *nasutus* one finds both sharp-nosed ♂♂ and blunt-nosed ♀♀, but I do not find the material corresponds to the morphological differences as set forth by Laurent. For example the webbing on the outer toe extends on the last phalanx halfway between the last tubercle and the disk; in some specimens it may attain the disk, in others only the last joint. The extremes appear distinct of course but the majority are intermediate and I suppose are what Dr. Laurent (p. 68) considers hybrids. I believe he is attempting to separate what is not separable in nature. I find no grounds for supposing that all our material from Angola, the Congo, Northern and Southern Rhodesia, Tanganyika and Kenya represent more than one species which should be called *nasutus*.

As an additional check, however, I submitted about fifty specimens from the half-dozen countries mentioned above, to Dr. W. C. Brown

of Northwestern University for an unbiassed opinion. I withheld the localities while asking him to employ every possible technique in an effort to see whether the material was divisible into one or more races. Finding that tabulation of a large number of various measurements produced no results, Dr. Brown divided the series on certain characters. These appeared to have some relation to alcohol versus formalin preservation but showed no correlation with geographical distribution. Indeed it frequently separated pairs or series taken at the same time in the same place and split the Laurent material of two of the alleged species. This material is available to any discriminating herpetologist who is interested in a further investigation of the problem.

Variation. (Chibotela frog only). Distance from end of snout to nostril about three-quarters that between nostril and eye; outer finger with terminal phalanx and disk free of web; first and fourth toes with one phalanx and disk free of web, the remaining toes with only half a phalanx and disk free of web; tibio-tarsal articulation of adpressed hind limb attains to halfway between eye and nostril; skin rough above; on throat (no disk) and belly granular.

Color. Stained; from snout to anus a series of brown dots, two similar lines (undoubtedly enclosing a light lateral band) extend from nostril over eyelid along the flanks.

Size. Snout to anus of imm. ♂, 16 mm.; of tailless juvenile (M.C.Z. 27500), 13 mm.

RANIDAE

Rana galamensis bravana (Peters)

Limnodytes bravanus Peters, 1882, Sitzb. Ges. naturf. Freunde Berlin, p. 3: "Barawa," i.e. Brava, Italian Somaliland.

♀ (A.M.N.H. 53245) Likabula River. 19.vi.–18.vii.46.

Records. New for Nyasaland, though long known from Mozambique as far south as Beira (Boulenger, 1907j, Proc. Zool. Soc. London, p. 481). The East African race differs from typical *galamensis* of Senegal in the greater extent of its webbing.

Variation. From eye to above groin is a conspicuous, broad, brown, dorso-lateral, glandular fold; tibio-tarsal articulation of adpressed hind limb attains eye; length of tibia less than half the length from snout to anus; fourth toe with two phalanges free of web, fifth toe with one free.

Size. Snout to anus of ♀, 60 mm.

Rana fuscigula angolensis Bocage

Rana angolensis Bocage, 1866b, Jorn. Sci. Lisboa, **1**, p. 73: Duque de Bragança, Angola. Boulenger, 1897e, p. 801; Johnston, 1898, p. 361a.

Rana nyassae Günther, 1893 (1892), Proc. Zool. Soc. London, p. 558: "Shire Highlands, principally upon Mount Zomba and Mount Milanji," Nyasaland. Boulenger, 1894d, p. 641; Bocage, 1896a, p. 104; Johnston, 1897, p. 362; 1898, p. 361a; Noble, 1924, p. 342.

Rana fuscigula Boulenger (not of Duméril & Bibron), 1897e, p. 801; Johnston, 1898, p. 361a.

Spawn, 33 tads., 2 ♂♂, 11 ♀♀ (M.C.Z. 27320–9) Misuku Mtns. 11.x.48.
2 ♂♂, 2 ♀♀ (M.C.Z. 27330–3) Nyika Plat. 13.xi.48.
4 tads., 1 juv., 4 ♂♂, 4 ♀♀ (M.C.Z. 27360–9) Nchenachena. 20.xi.48.
♀ (M.C.Z. 27334) Nchisi Mtn. 1–4.xii.48.
2 ♂♂, 4 ♀♀ (M.C.Z. 27335–9) Chitala R. 17.xii.48.
1 tad., 5 ♂♂, 10 ♀♀ (M.C.Z. 27340–4) Zomba Plat. 3.ix.48.
1 juv., 2 ♂♂, 6 ♀♀ (M.C.Z. 27345–9) Chiradzulu. 26.viii.48.
2 juv. (M.C.Z. 27350) Hynde Dam. 28.xii.48.
2 ♂♂, 1 imm. ♀ (M.C.Z. 27351–3) Cholo Mtn. 11.iii.49.
3 ♂♂ (M.C.Z. 27357–9) Ruo River. 2.iv.49.
7 tads., 1 ♀ (M.C.Z. 27354–6) Likabula R. 4.viii.48.
♀ (A.M.N.H. 53246) Likabula R. vi–vii.46.

Records. Fort Hill (but more probably the adjacent Misuku Mtns., for Boulenger's identification is correct); Nyika Plateau (as *fuscigula:* B); Zomba (as *nyassae:* G). There are other adults from Zomba (J. R. Lennon), and tadpoles from Livingstonia (W. P. Young) in the British Museum.

Variation. Tibio-tarsal articulation of the adpressed hind limb attains nostril (in 3 ex. Nyika and Chiradzulu) or beyond end of snout (63); length of tibia more than half the length from snout to anus; fourth toe with from 1 (usually) to 2 (rarely) phalanges free of web; fifth toe with 1 (15) or half a phalanx (36) free, or webbed to the tip (15). See also remarks under *f. fuscigula.*

Color. A light vertebral stripe is present in all 4 Nyika frogs but in only 2 of the 13 Misuku, 3 of the 15 Zomba, 6 of the 9 from Chiradzulu, and in none of the Nchenachena series. These Nchenachena frogs were a pale yellowish green in life and lack the white suborbital bar so characteristic of *fuscigula* subsp. Instead the region of the upper lip from nostril to tympanum is vermiculated with brown. Their appearance differed from all other *angolensis* so much that in the field I noted they were possibly a new form; however, in the laboratory no

grounds for separation could be found other than their rather smaller size.

Dr. H. W. Parker writes (19.iii.47) me that the type of *nyassae* was long ago transferred to the synonymy of *angolensis* by Boulenger, a disposition with which he and I are in agreement. If our Zomba series is topotypic it seems strange that neither they nor any other of our Nyasaland *angolensis* have the abdomen "largely marbled with dark brown" as described for the type, which I have seen (1952). Other *angolensis* in the collection are occasionally so marbled. One Zomba ♂ (M.C.Z. 27342) might be said to have the throat "nearly entirely dark brown," as in the heavily pigmented type of *nyassae*.

Size. Snout to anus of ♂♂, 44–65 mm., largest ♂ M.C.Z. 27357; of ♀♀, 50–87 mm., largest ♀ M.C.Z. 27334, but surpassed by one (B.M.97.6.9.151) of 95 mm., allegedly from Fort Hill.

Breeding. Tadpoles present in August (Mlanje), September (Zomba), October (Misuku, where frogs were also paired and spawning on the 11th), and November (Nchenachena).

Enemies. Undigested hind limbs present in the stomach of a snake (*Crotaphopeltis h. hotamboeia*).

Habitat. Taken in streams or pools both within and without the evergreen forest on Zomba, Chiradzulu and Mlanje Mountains. In one small brook they liked to rest with only their nostrils out of water at the sides of the larger pools where they were more or less concealed by the fringing vegetation.

Rana fuscigula fuscigula Duméril & Bibron

Rana fuscigula Duméril & Bibron, 1841, Erpét. Gén., **8**, p. 386: South Africa.

1 ♂, 2 ♀♀ (M.C.Z. 27373–5) Misuku Mtns. 6.x.48.
31 tads. & juv., 4 ♂♂, 3 ♀♀ (M.C.Z. 27306–16) Nchisi Mtn. xii.48.
1 ♂, 2 ♀♀ (M.C.Z. 27317–9) Chowe. 12.ii.49.

Records. Boulenger's (1897e) material is referred to *R. f. angolensis*, but one of the Nyika series of seven would key to *R. f. fuscigula*.

Native names of Dusky-throated Frog. *Kasanda* (Misuku); *nachidive* (Nyanja).

Variation. Tibio-tarsal articulation of the adpressed hind limb attains the eye (in 1), the nostril (8), end of snout (2), or just beyond (2); length of tibia about half the length from snout to anus; fourth toe with 1 phalanx (5), 1½ phalanges (5), or 2 phalanges (3 Chowe

frogs) free of web; fifth toe with 1 (3 Chowe frogs) or half a phalanx (4) free, or webbed to the tip (6).

From this it will be seen that in the matter of webbing the Chowe frogs should be referred to *angolensis*, but in tibial length they are certainly *fuscigula*. The variability displayed by both forms (which see) is such as to make one wonder if it is worth while attempting to separate races. The key (Loveridge, 1933b, p. 364) which sufficed to distinguish the three forms north of the equator, certainly requires modification in Nyasaland where the webbing runs the same gamut of variation, though with appreciably different ratios for the short-legged, supposedly lowland, *f. fuscigula*, and the long-legged, usually upland, *f. angolensis*. I assume that, following deforestation, the two forms now interbreed wherever they meet and mingle.

Color. A light vertebral stripe is present in all three Chowe frogs but in only one (♀) of the Misuku, and one (♂) of the Nchisi series apart from a couple of juveniles. Throats exhibit dusky vermiculations (often very faint) except in youngest (34 mm.) ♂; bellies white, only marbled on the flanks.

Size. Snout to anus of ♂♂, 44–68 mm., largest ♂ M.C.Z. 27309; of ♀♀, 55–88 mm., largest ♀ M.C.Z. 27319.

Habitat. The three Misuku frogs were brought to me in a gourd from Mwenichiula's Village far below our camp. In the vicinity of the latter we drained a pond to secure the series of *f. angolensis*. It is assumed that a similar situation occurs on Nchisi Mountain and the single *f. angolensis* may have been taken at some point above the Boma garden where we captured most or all of the *f. fuscigula*. The Chowe frogs were taken in Dr. Lamborn's garden up in the Mangoche Hills *circa* 3200 feet.

Rana johnstoni Günther

Rana johnstoni Günther, 1894a (1893), Proc. Zool. Soc. London, pp. 618, 620: "Tshiromo," i.e. Chiromo, Nyasaland. Boulenger, 1894d, p. 641; Bocage, 1896a, p. 104; Johnston, 1897, p. 362; 1898, p. 361a; Noble, 1924, p. 340.

2 Cotypes (B.M. 93.10.26.76–77; now 47.2.32.31–32) Chiromo.

Variation. Tibio-tarsal articulation of the adpressed hind limb attains the nostril (47.2.31.31) or barely end of snout (47.2.31.32); length of tibia just over half the length from snout to anus ($\frac{25}{49}$ & $\frac{27}{47}$); fourth toe with 1 phalanx (47.2.31.31) or 2 phalanges (47.2.31.32) free of web (except for a narrow seam on the second phalanx); fifth toe

with half a phalanx free or webbed to the tip.

Color. While one (47.2.31.32) of the rather soft cotypes is dark brown and might well pass for a *fuscigula*, the other (47.2.31.31) is variegated all over with white markings on a brown ground; the fore and hind limbs are barred.

Remarks. Still only known from the cotypes in the British Museum, for the five subsequent references are merely listings. Distinguished from *f. fuscigula*, of which it may prove to be a subspecies if not merely just aberrant, by the smaller tympanum, which is about half (rather than "one third") the orbital diameter. The ratio of eye (measured horizontally) to tympanum (measured vertically) is, according to Parker, $\frac{5.9}{2.1}$ on the right, $\frac{5.2}{2.4}$ on the left for the larger frog; $\frac{5.6}{2.4}$ on the right, and $\frac{5.5}{2.6}$ mm. on the left for the smaller. The variation, he says, results from whether the eye is open or closed.

Rana oxyrhynchus gribinguiensis Angel

Rana oxyrhynchus Boulenger (not of Smith), 1897e, p. 801.

Rana (Ptychadena) Gribinguiensis Angel, 1922d, Bull. Mus. Hist. Nat. Paris, **23**, p. 399, fig. : Fort Crampel, Lake Chad, French West Africa.

4 ♂♂, 1 ♀ (M.C.Z. 27380–4) Misuku Mtns. 25.ix.48.
♀ (M.C.Z. 27385) Nchenachena. 20.xi.48.
2 juv., ♂ ♀ (M.C.Z. 27386–7) Nchisi Mtn. 2.xii.48.
♀ (M.C.Z. 27400) Cholo Mtn. 11.iii.49.

Records. This race is new to Nyasaland, but Boulenger's two specimens from the Nyika Plateau, on whose lower slopes is Nchenachena, are certainly referable to this race.

Native names of the Montane Sharp-nosed Frog. *Kasoto* (Misuku).

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches far beyond end of snout; length of tibia much more than half the length from snout to anus (usually equals the distance from anus to occiput or eyes); first, second, third, and fifth toes webbed to the tip or almost so; fourth toe with only 1 phalanx free; black-lined vocal sacs distinguish the males.

Size. Snout to anus of ♂♂, 49–57 mm., largest ♂ M.C.Z. 27383; of ♀♀, 58–61 mm., largest ♀ M.C.Z. 27385; 2 juveniles 17–19 mm.

Parasites. Two pairs (♂ ♀) of nematodes (*Aplectana sp.*) were present in the digestive tract.

Enemies. Two recovered from the stomachs of *Philothamnus, i.*

irregularis, and four from as many Cape Vine-Snakes (*Thelotornis k. capensis*).

Habitat. Close to Matipa Forest along the banks of a stream into which they took prodigious leaps when disturbed by anyone approaching.

Rana oxyrhynchus oxyrhynchus Smith

Rana oxyrhynchus (Sundevall) A. Smith, 1849, Illus. Zool. S. Africa, Rept., pl. lxxvii, figs. 2 and 2a–c: Kaffirland and the region of Port Natal, South Africa. Boulenger, 1897e, p. 801; Johnston, 1898, p. 361a.

3 ♂♂ (M.C.Z. 27390–2) Mtimbuka. 12.ii.49.
2 juv. (M.C.Z. 27388–9) Hynde Dam, Limbe. 28.xii.48.
119 ♂♂, 24 ♀♀ (M.C.Z. 27393–9) near Tete, M. 22–24.i.49.

Records. Karonga to Kondowe (B). Also specimens from Monkey Bay (C. Christy) and Zomba (J. R. Lennon) in British Museum.

Native names of the Savanna Sharp-nosed Frog. *Zonde* (Chewa; Ngoni); *nyaukanzondo* (Nyungwe).

Variation. Tibio-tarsal articulation of the adpressed hind limb attains end of snout or, more usually, well beyond; length of tibia much more than half the length from snout to anus; first, second, third and fifth toes with at most half a phalanx free, fourth toe with 1½ or 2 phalanges free; black-lined vocal sacs distinguish the males.

Color. Occasional individuals in the Tete series lack dorsal markings and consequently look very different from the rest.

Size. Snout to anus of ♂♂, 38–44 mm., largest ♂ M.C.Z. 27393; of ♀♀, 49–58 mm., largest ♀ M.C.Z. 27396; of juveniles 21–24 mm.

Enemies. Recovered from the stomachs of a Hissing Sand-Snake (*Psammophis s. sibilans*) and young Egyptian Cobra (*Naja h. haje*) found hiding in same habitat near Tete.

Habitat. All the "Tete" series were found beneath damp debris left on a sandbar by the receding Zambezi, some at a point opposite Kasumbadedza village, others a few miles nearer Tete. This habitat they shared with *Rana floweri*, the proportions being 74 *oxyrhynchus* to 19 *floweri* on the morning of the 24th, 62 to 4 in the evening.

Rana floweri Boulenger

Rana floweri Boulenger, 1917c, Ann. Mag. Nat. Hist. (8), **20**, p. 417: Rosaires, Blue Nile, Anglo-Egyptian Sudan.

Abrana cotti Parker, 1931a (1930), Proc. Zool. Soc. London, p. 893, fig. 1: Charre, just north of Zambezi Bridge, Mozambique.

8 ♂♂, 15 ♀♀ (M.C.Z. 27373–9) near Tete, M. 22–24.i.49.

Records. Unknown from Nyasaland where it is likely to occur in the Shire Valley.

Native name. Nyankandeli (Nyungwe).

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches the eye (9), beyond (8), or nostril (6) irrespective of sex though ♀♀ average shorter limbs; length of tibia more or less than half the length from snout to anus; first and third toes usually with 1 phalanx free, second and fifth with at most ½ a phalanx free, usually rather barely webbed to tip; fourth toe with 2 phalanges free; black-lined vocal sacs distinguish the males.

Color. No light vertebral stripe, the back being chequered with longitudinally elongate, rectangular, black blotches. Below, white, immaculate in both sexes.

Size. Snout to anus of ♂♂, 43–48 mm., the largest ♂ M.C.Z. 27373; of ♀♀, 43–49 mm., the largest ♀ M.C.Z. 27376; average for entire series 46 mm.

Habitat. Sunken in damp sand under debris deposited on sand bars by the shrinking Zambezi River. Occurring with them were 143 of the related, but much more active, *o. oxyrhynchus.*

Rana mascareniensis mascareniensis Duméril & Bibron

Rana Mascareniensis Duméril & Bibron, 1841, Erpét. Gén., 8, p. 350: Madagascar; Mauritius; Seychelles; Boulenger, 1897e, p. 801; Johnston, 1898, p. 361a.

2 hgr. (M.C.Z. 27401–2) Dedza. 21.xii.48.

Records. Karonga to Kondowe (B); "Nyika Plateau" (B). Boulenger's (1897e) records of *mascareniensis* are identified correctly, but it is highly improbable that the typical form occurs on the Nyika Plateau at 6000 to 7000 feet.

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches far beyond end of snout (just beyond to far beyond in the British Museum material); length of tibia much more than half the length from snout to anus; first, second, third, and fifth toes with 1 phalanx free of web (not so certain in the now macerated Karonga series); fourth toe with 2 phalanges free; black-lined vocal sacs

distinguish the males (in our Malagasy series).

Size. Snout to anus of halfgrown, 31–34 mm.; of ♀ (B.M. ex. "Nyika"), 42 mm.

Habitat. Taken in drainage ditch of cow pasture by swamp just below the Angoni Highlands Hotel.

Rana mascareniensis mossambica Peters

Rana Mossambica Peters, 1854, Ber. Akad. Wiss. Berlin, p. 626: "Tette" . i.e. Tete (now restricted), Boror; Cabaceira; and Quilimane, Mozambique.
Rana mascareniensis Günther (not of Duméril & Bibron), 1895, p. 526.
Rana Vernayi FitzSimons, October 1932, Ann. Transvaal Mus., **15**, p. 39; 1935b, **16**, p. 383, figs. 3 & 4: Metsimaklaba River, Bechuanaland Protectorate.

♀ (M.C.Z. 27404) Nchisi Mtn. –.xii.48.
♂ (M.C.Z. 27405) Mtimbuka. 12.ii.49.
♀ (M.C.Z. 27406) Chowe, Mangoche. 12.ii.49.
6 ♂♂, 5 ♀♀ (M.C.Z. 27407–10) near Tete, M. 22–24.i.49.

Records. Marimba 13°10′ S., 33°20′ E. (J.E.S. Old) in Brit. Mus.; Shire Highlands (G), presumably around Blantyre or Zomba.

Native name of Mozambique Mascarene-Frog. *Zonde* (Chewa; Ngoni).

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches eye or nostril; length of tibia half[1] (Mozambique) to more than half (Nyasaland) the length from snout to anus; first toe with 2 phalanges free of web, second and third with 1½, fourth with 3, and fifth with 1 phalanx free; black-lined vocal sacs distinguish the males.

Synonymy. One of the specimens of *vernayi* (V.L.K.E. 965, now M.C.Z. 17714) taken with the type, has been compared with topotypes of *mossambica* and I find them inseparable. In view of the immaturity of FitzSimons' entire series the vomerine teeth do not differ significantly from those of *m. mascareniensis.* The outer metatarsal tubercle stressed by FitzSimons is present and conspicuous in all the Mozambique and Nyasaland frogs listed above. Indeed this is the only character that distinguishes it from *m. uzungwensis* in which the outer metatarsal tubercle is lacking, though sometimes represented by a light spot. Doubtless *vernayi* came to be described owing to Boulenger's (1882a, p. 52) action in synonymizing *mossambica* with *mascareniensis,* though subsequently he regarded it (in ms. *fide* Parker) as a "variety".

[1] But half to more than half in Brit. Mus. Nyasaland material.

Color. A broad, light vertebral stripe is present in all, and serves to distinguish them in the field from *flowcri* and *oxyrhynchus* with which they associate.

Size. [1]Snout to anus of ♂♂, 35–44 mm.; of ♀♀, 41–48 mm., examples of 48 mm. were taken in all three localities where ♀♀ were found.

Habitat. The Mtimbuka frog was taken with *oxyrhynchus* in a water hole, from which they could not escape, two miles north of Fort Johnston. At Chowe beneath garden trash. Near Tete with *oxyrhynchus* (which see), a species that outnumbered them 13 to 1.

Rana mascareniensis uzungwensis Loveridge

Rana mascareniensis uzungwensis Loveridge, 1932, Bull. Mus. Comp. Zool., **72**, p. 384; Dabaga, Uzungwe Mountains, Tanganyika Territory.

♂ ♀ (M.C.Z. 27403) Lichenya Plateau. 13 & 19.viii.48.

Records. This race, which has never before been recorded from Nyasaland, should be looked for on the high mountains to the north.

Remarks. R. m. uzungwensis was erroneously synonymized by Schmidt (1936, p. 129) with *subpunctata* Bocage, 1866, a very different frog with extensive webbing like *oxyrhynchus.* While the frogs from Chitau and Gauca, Angola, that Schmidt had, and some of which I have seen, are unquestionably *m. uzungwensis, Rana anchietae* Bocage, 1866 (1867), with whose description Schmidt compared them, is in reality a synonym of *oxyrhynchus* and should be removed from the synonymy of *subpunctata,* where it was placed by Schmidt. On the other hand *R. porosissima* Steindachner, 1867, is a synonym of *subpunctata,* as is also *chobiensis* FitzSimons, 1932.

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches far beyond end of snout (nostril to end of snout in the three paratypes from Benguela to Bihe, Angola, in the British Museum); length of tibia much more than half the length from snout to anus; webbing exactly as recorded for *m. mossambica,* from which it differs in the absence of a well-defined outer metatarsal tubercle, and, locally perhaps, in the longer hind limb.

Color. Unlike the type series, these two frogs from Mlanje Mountain are exceptionally dark, the ♂ lacking a vertebral stripe which in the female is reduced to a hairlike line.

[1] Applies also to Brit. Mus. material.

Size. Snout to anus of ♂, 32 mm.; of ♀, 38 mm.

Habitat. The ♀ was dug up in the garden, where it was presumably hibernating, fifty yards from a rivulet in whose vicinity the ♂ was taken.

Rana ansorgii Boulenger

Rana ansorgii Boulenger, 1905c, Ann. Mag. Nat. Hist. (7), **16**, p. 107, pl. iv, fig. 1: Between Benguela and Bihe, Angola.

3 juv. (M.C.Z. 27411–3) Chiradzulu Mtn. 26.viii.48
4 ♀♀ (M.C.Z. 27414–7) Likabula River. 4.viii.48.
♂, 6 ♀♀ (M.C.Z. 27418–24) Lichenya Plateau. 13.viii.48.

Records. New to Nyasaland but occurs in southeastern Tanganyika.

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches end of snout or well beyond; length of tibia much more than half the length from snout to anus; first, second, third and fifth toes with 2 phalanges free of web, fourth toe with 3 phalanges free; black-lined vocal sacs distinguish the males.

Color. Usually there is a characteristic solid dusky line following the contour of the lower jaw around from shoulder to shoulder.

Size. Snout to anus of ♂, 36 mm.; of ♀♀, 35–43 mm.; of juveniles 24–27 mm.

Habitat. The Chiradzulu juveniles were taken in the stream behind the Boma; the Likabula frogs from a swamp beside the Forestry Depot; the Lichenya series in the streamlet meandering through a forest copse behind Araloon Cottage. There they were constantly calling "tink-tink," a note having a distinct resemblance to the squeaky noise made by a loose-jointed table. The same call was heard from streams on the moorland as far distant as halfway to Chambe Plateau, but the banks were so undercut we never saw a frog. Presumably they were of the same species as those that hid in, or under, the thick tussocks of grass at the stream's edge and, when disturbed, plunged in and without pause buried themselves in the mud at the bottom.

Rana fasciata fülleborni Nieden

Rana fasciata Günther, (not of Tschudi) 1893 (1892), p. 555; Johnston, 1897, p. 362; 1898, p. 361a.

Rana fülleborni Nieden, 1910, Sitzb. Ges. naturf. Freunde Berlin, p. 436: Ngosi Volcano Crater Lake, Poroto Mountains, Tanganyika Territory.

Rana fasciata merumontana Loveridge (not of Lönnberg), 1933h, p. 372.

3 ♀ ♀ (A.M.N.H. 53249–51) Nyika Plateau. *ca.* 11.viii.46.
21 juv., 45 ad. (M.C.Z. 27430–9) Nyika Plateau. 28.x.–18.xi.48.
5 ♂ ♂, 1 ♀ (M.C.Z. 27425–9) Likabula River. 4.vii.48.

Records. Shire Highlands (G); Zomba Plateau (Mitchell ms).

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches end of snout (in young and then but rarely) or far beyond; length of tibia much more than half the length from snout to anus; first and second toe with 2 phalanges free of web, third and fifth toes with 3, and fourth with 4 phalanges free; males *without* black-lined vocal sacs at base of lower jaws.

Remarks. When, with some misgivings, I (1933h, p. 372) synonymized *fülleborni* with the northern *merumontana*, I pointed out the intermediate character of the southern Tanganyika frogs of which we had ample material from the Poroto, Ukinga, and Uzungwe Mountains. A study of the new material from northern and southern Nyasaland makes me reverse the former view and revive *fülleborni* as a race on the basis of pattern and size.

I am indebted to my colleague, Mr. Benjamin Shreve, for painstakingly examining and recording the data for about 125 *fasciata* subsp. in the collection of the Museum of Comparative Zoology. This revealed that the extent of the webbing on the toes was the same in all races, viz. from the first to the fifth their free phalanges were 2, 2, 3, 4, 3. It was observed that the left leg is frequently slightly shorter than the right, which results in an element of error for the left was chiefly, though not invariably, utilized for ascertaining the point to which the tibio-tarsal articulation of the adpressed hind limb attained. The results were as follow :

Race	*reached snout*	*just beyond*	*well or far beyond*	*Number examined*
f. merumontana (N. Tanganyika)	21	7	0	28
f. fülleborni (S. Tanganyika)	1	8	19	28
f. fülleborni (N. & S. Nyasaland)	1	7	20	28
f. fasciata + *f. montana* (S. Africa)	5	8	22	35

From this it would appear that Nyasaland frogs are nearer to *fasciata* than to *f. merumontana*. We have paratype material of *f. montana* FitzSimons, 1946, which differs principally from typical *fasciata* in color and pattern.

Color. The black lateral lines of *f. fasciata* are broken up into dashes or spots in the great majority of *f. fülleborni*, a race that is noticeably larger than the others.

Size. Snout to anus of ♂♂, 34–37 mm., largest ♂♂ M.C.Z. 27426–7; of ♀♀, 38–52 mm., largest ♀ M.C.Z. 27435.

Enemies. One frog (M.C.Z. 27426) exhibits slight (5 mm.) regeneration of right leg below knee where it had doubtless been seized in its youth by some predator.

Rana adspersa edulis (Peters)

Pyxicephalus edulis Peters, 1854, Ber. Akad. Wiss. Berlin, p. 626: Boror; Mozambique; and Tete (now restricted), Mozambique.

Pyxicephalus adspersa var. Günther, 1895, pp. 526–7.

Rana adspersa Mitchell (not of Tschudi), 1946, pp. 30, 42.

Rana adspersa edulis Loveridge, 1950b, p. 253 (habits and history and localities to date).

2 ♂♂, 2 ♀♀ (M.C.Z. 27440–3) near Tete, M. 17–27.i.49.

Records. "Shire Highlands" (G: based on a 63 mm. bullfrog); Port Herald (M); Rift Valley (M). Chiromo (M. ms.); Chitala River (M. ms.).

Native name of the Edible Bullfrog. *Sesi* (Nyungwe).

Variation. Tibio-tarsal articulation of the adpressed hind limb reaches the axilla; length of tibia about one-third the length from snout to anus; first and second toes with 1 phalanx projecting free from fleshy base, third and fifth with 2 phalanges free, fourth toe with 3 phalanges free; males indistinguishable except by their lemon-yellow throats and flanks which possibly is not peculiar to males.

Size. Snout to anus of ♂♂, 83–117 mm.; of ♀♀, 85–85 mm.

Breeding. Both ♀♀ were gravid.

Enemies. One was recovered from the stomach of a monitor lizard (*Varanus n. niloticus*), another was harassed during the night by driver ants which probably drove it above ground in my tent.

Habitat. On January 17, despite absence of rain and daily temperatures of 100° between noon and 4 P.M., at 5.30 P.M., i.e. an hour before sundown, I heard one of these fossorial frogs moving among

dead leaves drifted beneath a pile of thorn branches. The amphibian retired into a rat hole from which we dug it.

Rana delalandii delalandii (Duméril & Bibron)

Pyxicephalus Delalandii Duméril & Bibron, 1841, Erpét. Gén., 8, p. 445, pl. lxxxvii, figs. 1–1b: South Africa.

Arthroleptis rosei Hoffman, 1944b, Soölog. Navors. Nas. Mus. Bloemfontein, No. 14, p. 174, figs. 1–4: "Chitiala" i.e. Chitala River, Nyasaland. Rose, 1950, p. 112.

Records. Though *delalandii*, which occurs in all surrounding countries, has as yet never been recorded from Nyasaland, Mr. B. L. Mitchell, who collected the type of *rosei*, informs me that he also took *delalandii* at Chitala River. This is precisely the type of habitat favored by this fossorial frog of the subgenus *Pyxicephalus*, though some herpetologists not unreasonably prefer to give the group full generic status.

Synonymy. After comparing Hoffman's somewhat rough sketches of the rather striking dorsal pattern of *Arthroleptis rosei* with young *delalandii* of comparable size, I came to the conclusion that Hoffman's 27 mm. type was *not* an adult ♀ *Arthroleptis* as he states, but an immature *delalandii* with typical spade-like inner metatarsal tubercle, but no outer tubercle. This conclusion is confirmed by an examination of the 18 mm. paratype (A 2673) which has vomerine teeth. Allegedly a ♀, it has never been dissected and may well be too young to sex with certainty.

Phrynobatrachus perpalmatus Boulenger

Phrynobatrachus perpalmatus Boulenger, 1898b, Proc. Zool. Soc. London, p. 479, pl. xxxviii, fig. 1: Lake Mweru, Northern Rhodesia.

♀ (M.C.Z. 27550) Chitala R. 13.xii.48.
3 ♂♂, 11 ♀♀ (M.C.Z. 27540–9) Mtimbuka. 7.ii.49.
37 (M.C.Z. 27530–9) near Tete, M. 22–24.i.49.

Records. *P. perpalmatus* has not previously been recorded from Nyasaland though occurring in the surrounding countries. In 1940 Mertens identified material as *perpalmatus* from Mbamba Bay on the east shore of Lake Nyasa. My fresh material has been compared with cotypes of *acridoides* (Cope) and of *perpalmatus*, leaving me none too sure of the identification.

Native name. *Mondo* (Nyungwe).

Variation. Tympanum more or less distinct; tips of fingers more or less spatulate, those of the toes with tiny disks, to which the webbing extends on all toes except the fourth, as the disk occupies the greater part of the terminal phalanx it may be said that the phalanges free of web from first to fifth are 1, 1, 1, 1–1½, 1; tibio-tarsal articulation of the adpressed hind limb reaches eye (mostly ♀♀), between eye and nostril (both sexes), or nostril (some ♂♂). The right foot of M.C.Z. 27539 is forked, having healed or regenerated in this way.

Color. The characteristic dark bar from eye to commissure of mouth is indistinct or absent in these formalin-preserved specimens; a light, hair-like vertebral band is present in six Mtimbuka but only two Tete frogs; however, several exhibit a pale brown, narrow or broad, ribbon-like mid-dorsal band; the oblique light lines on the buttocks are present or absent. Below, some subadults are almost entirely white, ranging to ♀♀ with most of the underside finely peppered with darker, and ♂♂ whose heavily infuscated dark throats show only scattered white spots posteriorly.

Size. Snout to anus of Mtimbuka ♂♂, 24–25 mm., of some Tete ♂♂, 23–25 mm.; of gravid Chitala and Mtimbuka ♀♀, 27–30 mm., of some Tete ♀♀, 27–29 mm. All Nyasaland, but only a dozen of the Mozambique frogs, were measured.

Breeding. In all localities on the dates specified, which normally cover the monsoon rains, most of the larger ♀♀ were distended with ova.

Enemies. One was recovered from the stomach of a sand-snake (*Psammophis s. sibilans*) near Tete; another from a vine-snake (*Thelotornis k. oatesii*) at Mtimbuka.

Habitat. The Chitala frog was taken in a puddle formed by a shower. I caught the Mtimbuka frogs in waterlogged grass behind Lamborn's house and close to the lake shore. The "near Tete" series were found in damp spots along the sandbars of the shrinking Zambezi both west and east of Kasumbadedza village.

Phrynobatrachus duckeri sp. nov.

Phrynobatrachus maculatus Hoffman (not of FitzSimons), 1944b, p. 176.

Type. M.C.Z., No. 27581, a gravid ♀ from a freshly formed pool in sandy soil in a corner of one of the Cotton Growers Experimental Station dams at Chitala River, Nyasaland. Collected by Arthur

Loveridge, December 13, 1948.

Paratypes. M.C.Z., Nos. 27580, 27582–3, being three ♂♂ (one now in British Museum) taken with the type. Also designated as paratypes are the nine specimens (Nas. Mus. Bloemfontein, No. 2595) of which one is now M.C.Z. 27777. Additional material, but not to be regarded as paratypes on account of their immaturity, are:

6 subadults (M.C.Z. 27584–9) Limbe 16.iv.49.

Diagnosis. Indistinguishable, except in size, from *P. natalensis*, a large series of which were obtained at 5000 feet on nearby Nchisi Mountain. The possibility of identifying these frogs with *ranoides* Boulenger — currently regarded as a synonym of *natalensis* — was considered and rejected after direct comparison had been made with the holotype ♂ of *ranoides* by Dr. W. H. Parker and myself. Dr. Parker kindly furnished me with the ratio of the horizontal diameter of tympanum to that of the eye of the pertinent material:

in the 22 mm. ♂ type of *ranoides* the ratio is 2.0 times.
in the 22 mm. ♂ paratype *duckeri* the ratio is 1.6 times.
in one 24 mm. ♂ paratype *duckeri* the ratio is 2.0 times.
in one 24 mm. ♂ paratype *duckeri* the ratio is 2.7 times.
in a 29 mm. ♂ of *natalensis* the ratio is 1.7 times.

Description. Tympanum more or less distinct; tips of fingers and toes not dilated; from first to fifth toes the phalanges free of web are 1, 1, 2, 3, 2; tibio-tarsal articulation of the adpressed hind limb reaches eye (♂, ♀, and subadults) or just beyond (♂♂ and subadults). See also Hoffman's detailed description.

Color. Above, substantially as described by Hoffman; but a light vertebral line is present in two of the Limbe frogs. Throats of the three breeding ♂♂ black, in sharp contrast to the almost pure white undersurfaces of the entire series which exhibit, at most, a faintly discernible pair of dusky marks on the chest.

Size. Snout to anus of breeding ♂♂, 22–24 mm., of gravid holotype ♀, 26.5 mm.; of non-breeding Limbe series 21–24 mm.

Breeding. The gravid ♀ is not exactly "slender" being 15 mm. broad.

Habitat. The Limbe frogs were captured at a pond many miles from Hynde Dam. I was conducted to the dam in which the Chitala series were obtained by Mr. H. C. Ducker, after whom I take pleasure in naming this new species, as being the most likely place from which Mr. B. L. Mitchell secured the nine specimens submitted to Hoffman.

Phrynobatrachus natalensis (Smith)

Sternorhynchus natalensis A. Smith, 1849, Illus. Zool. S. Africa, Rept., App., p. 24: Natal, Union of South Africa.

Phrynobatrachus acridoides Boulenger (not of Cope), 1879e, p. 801; Johnston, 1898, p. 361a.

1 ♂, 3 ♀♀ (M.C.Z. 27551–4) Misuku Mtns. 25.ix.48.
54 (M.C.Z. 27560–9) Nchisi Mtn. 27.xi.48.
2 ♀♀ (M.C.Z. 27555–6) Chiradzulu Mtn. 31.viii.48.
2 ♂♂, 2 ♀♀ (M.C.Z. 27557–9) Hynde Dam, Limbe. 28.xii.48.
44 (M.C.Z. 27570–9) Likabula R. 2.viii.48.

Records. Previously unrecorded from Nyasaland, but the specimens from the Misuku Mtns. and "Nyika Plateau" (which almost certainly came from lower down the mountain) listed as *acridoides* by Boulenger, were subsequently redetermined by him as *natalensis* and *ranoides*, though never published. I have seen them and consider all referable to *natalensis*. There are also others from Zomba (J. R. Lennon) in the British Museum.

Native name. Mbovu (Chewa and Ngoni).

Variation. Tympanum more or less distinct; tips of fingers and toes *not* dilated; from first to fifth toes the phalanges free of web are ½–1, ½–1, 1½–2; 2½–3; 1½–2 respectively; tibio-tarsal articulation of the adpressed hind limb reaches eye (55, both sexes), between eye and nostril (26, both sexes), or nostril (27, nearly all from the Likabula series in which immature frogs predominate).

Color. A light vertebral line is present in 10 of the 54 Nchisi frogs, in only 4 of the 44 from Likabula River, Mlanje Mountain.

Size. Snout to anus of largest ♂ (M.C.Z. 27560) and ♀ (M.C.Z. 27565), both 35 mm.; of 38 ♂♂, 26–35 mm.; of 14, mostly gravid, ♀♀, 28–35 mm.; of 57 unsexed, 21–34 mm.

Breeding. On August 2 (Likabula) not breeding; on 31st (Chiradzulu) ova small; on September 25 (Misuku) ova developing; on November 27 (Nchisi) assembled and breeding in pool; on December 28 (Limbe) one of the two ♀♀ was gravid.

Enemies. One recovered from stomach of a cobra (*Naja n. nigricollis*) at Likabula.

Phrynobatrachus ukingensis ukingensis (Loveridge)

Arthroleptis ukingensis Loveridge, March, 1932a, Bull. Mus. Comp. Zool., **72**, p. 385: Madehani, Ukinga Mountains, Tanganyika Territory.

27 ♂♂, 25 ♀♀, 11 juv. (M.C.Z. 27590–9) Misuku Mtns. 23–30.ix.48.

Records. New to Nyasaland. For occurrence of the lowland race *u. mababiensis* also in the Misuku Mountains, see *u. mababiensis*.

Remarks. On purely osteological grounds, Laurent (1941b, pp. 203 and 206) has clarified the recurring confusion between *Arthroleptis* and *Phrynobatrachus* by transferring those intermediate forms of "*Arthroleptis*" (*Parathroleptis* of E. Ahl) possessing a tarsal as well as two metatarsal tubercles, to *Phrynobatrachus* where he groups them as a subgenus (*Parathroleptis*). I have followed this arrangement. It interests me for it removes from *Arthroleptis* those forms with normal pond-spawning habits, while leaving in *Arthroleptis* the species — so far as their breeding habits are known — which deposit their eggs in burrows excavated by the maternal metatarsal tubercle.

When describing *ukingensis* I compared it with *minutus*, but this abundant Nyasaland material containing numerous black-throated ♂♂ reveals this forest frog to be even nearer to *mababiensis*, from which it can be separated only by the digital disks. This character, usually associated in ranids with rain-forest species, was apparently lost when *ukingensis* took to upland marshes or alpine meadows. The types of *u. ukingensis* were taken in swampy ground just outside the forest, while *u. mababiensis* (as "*parvulus*") occurred on the undulating grasslands.

Variation. Tympanum hidden; tips of the fingers more or less spatulate, most of the toes with tiny disks; toes with only a trace of web at base, the phalanges free of web from first to fifth being 2, 2, 3, 4, 3; tibio-tarsal articulation of the adpressed hind limb falls short of (14) or reaches (49) the eye.

Size. Snout to anus of 27 ♂♂, 15–17 mm.; of 25 ♀♀, 16–22 mm.; of 11 juv., 9–13 mm. Every individual measured and tabulated.

Breeding. On October 11, many tadpoles, presumably of this frog, were collected and preserved.

Enemies. One recovered from the stomach of a *Crotaphopeltis h. tornieri*, remains of two others in a viper (*Atheris n. rungwensis*).

Habitat. Mostly from a boggy rivulet that meandered through a clearing in the evergreen forest, others in marshy ground abutting on the forest.

Phrynobatrachus ukingensis nyikae subsp. nov.

Type. M.C.Z. No. 27609, a gravid ♀ from marshy ground on the

Nyika Plateau above Nchenachena, at 7000 feet, Nyasaland. Collected by Arthur Loveridge, about November 1, 1948.

Paratypes. M.C.Z. Nos. 27600–8, together with uncatalogued duplicates, having same data as the type but collected October 29 to November 6, 1948. Also A.M.N.H., Nos. 55337–8, being two juveniles collected by Dr. L. J. Brass, August 11, 1946.

Diagnosis. Distinguished from the lowland *u. mababiensis* by the tibio-tarsal articulation of the adpressed hind limb failing to reach the eye in 98 of the 103 specimens, also by the much darker coloring which is black above and very heavily infuscated below except in the youngest frogs.

Description. Characters substantially those of *u. mababiensis,* but the tibio-tarsal articulation of the adpressed hind limb reaches only to the shoulder (and to the eye in only 5 per cent of the material of which every specimen was tested and measured).

Color of Type ♀. Above, blackish, from snout to anus a light, hair-like, vertebral line (absent in almost all the paratypes). Below, lips, breast and belly heavily marbled with blackish brown; throat and thighs stippled with brown so as to almost obscure the white ground color; underside of forelimbs white.

Size. Snout to anus of 65 ♂♂, 14–17 mm.; of 24 ♀♀, 16–20 mm., only the type ♀ (M.C.Z. 27609) measured 20 mm.; of 13 juv. 10–15 mm.

Breeding. The black-throated ♂♂ were calling from end of October to at least mid-November but, as will be seen from the foregoing figures, relatively few females had arrived.

Habitat. The boggy bottoms of the numerous valleys and ravines on the undulating plateau.

Phrynobatrachus ukingensis mababiensis FitzSimons

Phrynobatrachus mababiensis FitzSimons, March, 1932, Ann. Transvaal Mus., **15**, p. 40, and 1935b, *ibid.*, **16**, p. 390, fig. 26: Tsotsoroga Pan, Mababe Flats, Bechuanaland Protectorate (Type ♂, 15 mm.).

Phrynobatrachus vanrooyeni Hoffman, 1940a, Soölog. Navors. Nas. Mus. Bloemfontein, **1**, p. 99, fig. 2B: Broedershock, Greytown, Natal (Type ♀, 16 mm., paratype ♂, 16 mm.).

Phrynobatrachus chitialaensis Hoffman, 1944b, Soölog. Navors. Nas. Mus. Bloemfontein, **1**, p. 177, figs. 5–6: "Chitiala," *i.e.* Chitala River, Nyasaland (Type ♂, 13 mm.). Mitchell (as *chitalensis*), 1946, p. 30.

Arthroleptis sp. Hoffman, 1944b, p. 176 (juv. 10 mm.).

8 ♂♂,	17 ♀♀,	28 juv.	(M.C.Z. 27610–9)	Nchenachena. 22.xi.48.
15 ♂♂,	9 ♀♀,	28 juv.	(M.C.Z. 27620–9)	Nchisi Mtn. 27.xi.48.
2 ♂♂,	3 ♀♀		(M.C.Z. 27630–4)	Chitala R. 16.xii.48.
	2 ♀♀,	2 juv.	(M.C.Z. 27635–6)	Dedza. 21.xii.48.
3 ♂♂			(M.C.Z. 27637–9)	Mtimbuka. 7.ii.49.
12 ♂♂,	20 ♀♀,	37 juv.	(M.C.Z. 27640–9)	Hynde Dam. 28.xii.48.
23 ♂♂,	8 ♀♀,	25 juv.	(M.C.Z. 27650–9)	Likabula R. 2.viii.48.
6 ♂♂,	15 ♀♀,	20 juv.	(M.C.Z. 27660–9)	near Tete, M. 24.i.49.

Records. Chitala (H) and Salima (M), both as *chitialensis*. Otherwise new to Nyasaland though there are three 10–11 mm. juveniles, allegedly from the Misuku Mountains, in the British Museum which Boulenger referred to *Arthroleptis minutus*, probably with misgivings for he omitted them from the 1897 report on Whyte's collection. As their digits display no disks they presumably came from dry uplands.

Synonymy. Having compared paratypes of *mababiensis* (M.C.Z. 17716–20) and *vanrooyeni* (M.C.Z. 24509–10) with topotypes of *chitialaensis* (M.C.Z. 27630–4), and the juvenile frog referred to *Arthroleptis* by Hoffman, I am satisfied that the numerous frogs from the mountains of southern Tanganyika Territory that I (1933h, p. 386) assigned to "*parvulus*" are in reality *u. mababiensis*. At the time I thought it improbable that montane frogs should be identical with a relatively low altitude species like *mababiensis*, but the form occurs from 4000 feet in Nyasaland down to 250 feet at Tete in Mozambique.

Since 1936 I have received frogs from localities in central Angola identified by Dr. H. W. Parker and K. P. Schmidt as *parvulus* Boulenger, 1905. Though these frogs are within the lengths ascribed to *mababiensis* below, they are at the upper limits of the range and consequently suggest that *parvulus*, whose solitary type was only 13 mm., is a western relative of *mababiensis* or a synonym of *minutus*.

In the 1933h citation I related how *minutus*, whose breeding ♂♂ have a chrome colored throat and a different call to the black-throated *mababiensis* (which I miscalled "*parvulus*"), was breeding in different parts of the same pool in the Uzungwe Mountains, but are otherwise indistinguishable except for size. It is possible that *minutus* ♀♀ are included in the Limbe series whose measurements are given below. Neither my colleague Benjamin Shreve, nor I, could find justifiable grounds for separating them.

Variation. Tympanum hidden; tips of fingers and toes not dilated; toes with only a trace of web at base, the phalanges free of web from

first to fifth toe being 2, 2, 3, 4, 3; tibio-tarsal articulation of the adpressed hind limb falls short of (occasionally) or reaches (usually) the eye (but only a few from each locality examined).

Color. Of the Limbe series 15 ♂♂, ranging from 14–17 mm., had black throats; 18 ♂♂, ranging from 16–19 mm. (so possibly referable to *minutus*), had dusky or whitish throats, as did also the 14–17 mm. Chitala ♂♂ whose throats were baggy, but white.

Size. Snout to anus of 69 ♂♂, 14–18 mm.; of 74 ♀♀, 16–22 mm.; of 140 juv., 11–15 mm. Both the 21 mm. and 22 mm. ♀♀ came from Limbe. Mitchell's (1946, p. 30) statement that "breeding females measured 13 mm." seems questionable.

Breeding. In August males were emitting their clicking call in a marsh at Likabula River. From end of November to end of January there were at least some gravid ♀♀ in every series taken, except at Dedza.

Habitat. At edge of a dessicating waterhole in Chitala River bed; in roadside ditches at foot of hill below Dedza hotel; the Mtimbuka frogs were taken at night in a waterlogged savanna; the Limbe series were congregated on mud or among grass at edge of the shrinking reservoirs; Likabula specimens were in a marsh near river and the Forestry Depot; while those from Mozambique were hiding beneath damp debris left on sandbars by the receding Zambezi River.

Arthroleptis xenodactyloides nyikae subsp. nov.

Type. M.C.Z. No. 27480, a gravid ♀ from the foot of the first Nchenachena Falls on the Nyika Plateau, about 7000 feet, Nyasaland. Collected by Arthur Loveridge, November 3, 1948.

Paratypes. M.C.Z. Nos. 27481–9, besides fifteen uncatalogued, taken at the same time and place as the type. Also M.C.Z. Nos. 27490–2, from beside stream in patch of forest nearest our camp at about 7000 feet.

Diagnosis. Distinguished from *x. xenodactyloides* Hewitt, 1933, of Selinda Mountain, Southern Rhodesia (38 topotypes of which are in the M.C.Z.), and *x. nkukae* Loveridge, 1942, from the Rungwe, Ukinga, and Uzungwe Mountains of southern Tanganyika Territory (350 paratypes of which are in the M.C.Z.), in its more deeply notched tongue (in which it approaches *xenodactylus* Boulenger), in having the throat and belly black marbled with white at all sizes from 8 to 23 mm. (in *x. xenodactyloides* the belly is white and the throat largely so

except in ♂♂ where it is dusky; in *x. nkukae* both throat and belly are white in the young but substantially like *x. nyikae* when adult) and by its larger size (gravid ♀ ♀ being 23–24 mm. instead of 18–19 mm.).

Description. Type ♀. Head not wider than body (also in paratypes); tympanum indistinct, two-thirds the orbital diameter; first finger shorter than second which extends as far as fifth when pressed together, fourth (on its outer side) twice as long as the fifth (this also applies to the apparently longer fourth finger of a ♂ paratype); tips of fingers and toes swollen or slightly dilated, their bases without webbing; tibio-tarsal articulation of the adpressed hind limb reaches the tympanum (the eye in 9 adult paratypes, just beyond the eye in 4 others); an inner, but no outer, metatarsal tubercle.

It is in substantial agreement with Hewitt's full and excellent description of *xenodactyloides*, apart from differences noted in the diagnosis above.

Color of ♀ type in life. Above, gray, a pale interocular patch edged with black behind; on scapular region are similar but smaller flecks; two others, also irregular in outline, on either side of lumbar region; a dark-edged circum-anal area extends forwards to about the end of the urostyle region; upper arm very pale, forearm dark; hind limb and all digits pale with darker mottling. Below, throat, forelimbs and belly black with silvery white flecks and spots (usually) most pronounced on chest and belly; hind limbs dark red (in adults only) with some silvery white and black flecking.

In the paratypes the color is very variable above, ranging from pale fawn and leaden gray to very dark with lighter and still darker patches, with or without the characteristic hour-glass pattern of the genus on the dorsum.

Size. Snout to anus of paratype ♂, 20 mm.; of type ♀, 23 mm.; while the range of the entire series is as follows: 8 mm. (2), 9 (4), 10 (2), 11 (5), 12 (1), 17 (3), 18 (2), 19 (4), 20 (2), 21 (1), 22 (1), 23 (1).

Breeding. In early November some of the larger frogs were gravid.

Habitat. The entire series from the base of the Falls was taken among, mostly beneath, a jumble of small boulders, interspersed with fallen leaves, beside the river where, so far as one could judge, the ground would always be damp.

Arthroleptis boulengeri de Witte

Arthroleptis boulengeri de Witte, 1921a, Revue Zool. Africaine, **9**, p. 12, pl. iv, fig. 2: St. Louis Plain bordering Lake Tanganyika, Belgian Congo.

20 juv. (M.C.Z. 27520-5) Misuku Mtns. 23–30.ix.48.
16 ♂♂, 18 ♀♀, 3 juv. (M.C.Z. 27509–19) Nchisi Mtn. 30.xi.48.
11 (M.C.Z. 27493–9) Zomba Mtn. 2–12.ix.48.
58 (M.C.Z. 27501–6) Chiradzulu Mtn. 26–31.viii.48.
♂ ♀ (M.C.Z. 27507–8) Cholo Mtn. 12.iii.49.
♂ (M.C.Z. 27457) Likabula River. 2.viii.48.

Records. New to Nyasaland.

Remarks. As direct comparison with the only known specimen[1] of *boulengeri* is not possible, the identification is open to question. I refer these frogs to *boulengeri* rather than to *lamcerei* — which has paragraph precedence should the two prove to be synonymous — because the metatarsal tubercle is much shorter than the inner toe. In the 11–18 mm. juveniles or subadults the tips of the fingers and toes are simple (as in the 14 mm. *lamcerei*) or swollen, but definitely dilated (as in the 16 mm. *boulengeri*) in all, or most, of the forty 14–24 mm. adults.

Variation. Every frog in the above series has been examined for each of the undermentioned characters excepting for those of the tympanum and first finger, in which case only a few from each locality were tested.

Tympanum distinct, or indistinct in very young, more than half to two-thirds the orbital diameter; first finger shorter than second; tips of fingers and toes usually slightly swollen or distinctly dilated, though sometimes not, their bases without web; tibio-tarsal articulation of the adpressed hind limb reaches the tympanum (in 33), the eye (in 82), or just beyond (in 16) — this may well be largely an age character for in the Misuku juveniles the articulation reaches the tympanum in 1, eye in 13, beyond in 6; while in the Nchisi series, mostly adults, it reaches the tympanum in 29, the eye in 8; a small inner metatarsal tubercle only. Third finger of ♂ (M.C.Z. 27507) three times as long as the fourth, of ♀ (M.C.Z. 27508) only about twice.

Color in life. ♂ (Cholo). Above, gray with sepia markings, principally a triple hour-glass pattern on dorsum, a stripe from nostril through eye to groin but interrupted on flank, and a prominent crossbar on tibia; thighs slightly pinkish. Below, white.

♀ (Cholo). Above, pinkish, finely and very extensively vermiculated with brown; the only other marking is an obsolescent stripe from nostril through eye to tympanum; thighs clear red. Below, white,

[1] Laurent has recently recorded 4 more from Angola.

some dusky flecks on skin while a plumbeous appearance is imparted to breast and belly by the internal organs.

Subadults (Chiradzulu). While most of the series displayed a dorsal hour-glass pattern in varying shades, a few were utterly different. The back of one was entirely occupied by a broad reddish chestnut, vertebral stripe, another had a pair of fawn-colored dorso-lateral stripes.

Size. Snout to anus of Nchisi adult ♂♂, 14–17 mm., but largest ♂ (M.C.Z. 27507), 18 mm. (19 in life); gravid Nchisi ♀♀, 18–20 mm., but largest ♀ (M.C.Z. 27508), 24 mm. (25 in life). Misuku frogs 12–18 mm., the Zomba and Chiradzulu series 11–18 mm.

Breeding. Not breeding between August 26 and September 30; but following rain on November 30, and on March 12, practically every ♀ was gravid. Strangely enough the Cholo ♂ was not taken with the gravid ♀, but an hour later came hopping into my tent following a rainstorm.

Habits & Habitats. The big Misuku series were mostly taken beside a stream flowing through Matipa Forest.

The Nchisi frogs were among damp leaves in a ravine close to the Boma where they were captured after heavy rain. Most of the Zomba frogs were secured in a small stream flowing down a ravine clothed in evergreen forest where it is crossed by the path to Chingwe's Hole, others were from a tiny tributary of the Mulungusi River, beside which one was dug from a hole that it shared with a young *Bufo r. regularis;* another was hiding beneath bark adjacent to a sawpit in the cedar forest. The Cholo ♀ was hopping over leaves in the forest just before rain, though the environment was already damp.

The entire Chiradzulu series were found beneath boulders and stones in the small rock-girt stream which supplies the District Commissioner's vegetable garden at 4000 to 4500 feet. As each large stone was lifted from its resting place in the shallow pools, the tiny frogs leaped about in all directions. A quite confusing tactic that tends to paralyse action by promoting indecision as to which of a score of bouncing froglets to pursue.

Arthroleptis reichei Nieden

Arthroleptis reichei Nieden, 1910b, Sitzb. Ges. Naturf. Freunde Berlin, p. 437: Crater Lake, Ngosi Volcano, Poroto Mountains, Tanganyika Territory.

♀ (M.C.Z. 27456) Misuku Mtns. 5.x.48.

Records. New to Nyasaland but to be expected as I have taken it in the Poroto, Rungwe, Ukinga and Uzungwe Mountains to the north.

Variation. Tympanum distinct, about half orbital diameter; first finger shorter than second; tips of fingers and toes slightly or strongly dilated, their bases without webs; tibio-tarsal articulation of the adpressed hind limb reaches the eye; a rather blunt inner metatarsal tubercle whose length is included about 1½ times in the free portion of the first toe.

Size. Snout to anus of gravid ♀, 34 mm.

Breeding. See above.

Habitat. Beneath a log in the evergreen Matipa Forest.

Arthroleptis adolfifriederici francei[1] subsp. nov.

Arthroleptis macrodactyla Günther (not of Boulenger), 1894a (1893), pp. 619 620; Bocage, 1896a, p. 104; Johnston, 1897, p. 362; 1898, p. 361a. [Al these records are based on a single, now macerated, 32 mm. frog (B.M 93.10.26.80) allegedly from Zomba, from where it was sent to the British Museum where I examined it. *A. macrodactylus* Boulenger (1882b, p. 117, pl. xi, fig. 5) of Gabon, now generally regarded as a synonym (♂) of *poecilonotus* (♀) Peters (1863) of Boutry, Gold Coast, is almost exactly the size of the Nyasaland frogs which, however, do not appear to be even subspecifically related.]

Holotype. M.C.Z. No. 27479, a gravid ♀ from the forested banks of the Ruo River just below the Ruo Falls on Mlanje Mountain, about 5000 feet. Collected by Arthur Loveridge, April 4, 1949.

Paratypes. M.C.Z. Nos. 27470–8 and twenty uncatalogued duplicates taken at the same time and place as the type.

Diagnosis. Obviously related to *adolfifriederici* Nieden of Central Africa, from which it differs in the much less developed dilations of fingers and toes (strongly dilated in *adolfifriederici*), the shorter hind limbs (which when adpressed in *adolfifriederici* reach from between eye and nostril to beyond end of snout), and general ground color (varying shades of nut brown in *adolfifriederici*).

Description. Type ♀. Head not wider than body (also in paratypes); tympanum distinct, half the orbital diameter (in entire series); first finger slightly shorter than second which extends as far as fifth when pressed together, fourth (on its outer side) less than twice as long

[1] After Mr. F. H. France, the keen young forestry officer who, in May 1949, lost his life in trying to cross the Ruo close to the spot from whence came these frogs. They are called after France that his name may be linked with the forests he sought to preserve on the mountain he loved so well.

as the fifth (twice as long in the ♂ paratypes); tips of fingers slightly, of toes strongly, swollen, their bases without webbing; tibio-tarsal articulation of the adpressed hind limb reaches the eye (as is the case with 26 of the paratypes) or between eye and nostril (in 3 instances); an inner, but no outer, metatarsal tubercle whose length is shorter than the first toe.

Color of ♀ type in life. Above, dark brownish red; from nostril through eye above (and on upper portion of) tympanum to above forearm, a deep black band edged with lighter above, especially pale on eyelid; from eyelid to eyelid an obsolescent crossbar; similar dusky markings occur as marblings on back, flanks, limbs and around anus. Below, pinkish white with underlying dusky markings and silvery white flecks on chest, sides of abdomen, posterior aspects of thighs, and on the almost blackish soles of hind feet; palms, fingers and toes more reddish.

A slightly smaller ♀ had the snout and anterior half of head pale pinkish buff, the black interorbital crossbar merging into the general black of the vertebral region which is dorso-laterally bounded by the same shade as the snout; on each flank, especially posteriorly, and on each hind limb, are a score of cream colored spots about whose edges are superposed small red dots that enhance this frog's striking appearance.

In alcohol the entire series is predominantly gray, but in life the ground color was gray, buff, fawn, pale green, or rich brick red. The vertebral hour-glass pattern characteristic of *Arthroleptis*, conspicuous in some, appears to be absent in others, but can usually be detected with the aid of a lens; dark dorso-lateral lines are present on two young frogs causing them to look a little like pinkish *Hyperolius*. Even more imposing is a 20 mm. juvenile that is black except for the tip of its snout, which is buffy, an almost whitish interorbital bar, and numerous white spots on back and limbs. Below, all are substantially the same as described for the type except that grayish, not pinkish, predominates.

Size. Snout to anus of paratype ♂ (M.C.Z. 27476), 32 mm.; of type ♀, 46 (49 just after death) mm.; the entire series ranges from 10 to 46 mm., but only nine frogs are over 30 mm.

Breeding. In April the ova were only moderately large.

Habitat. Unlike the equatorial forests of Tanganyika, Nyasaland forests at high altitudes apparently become too cold for amphibians owing to the drop in temperature when it comes on to rain. In a three-

hour (7 to 10 A.M.) walk up through the forest from the Power House under conditions that appeared ideal, I did not see a single frog. During the first two hours the enveloping cloud cap rendered it dull but afterwards intermittent shafts of sunlight illuminated stretches of the leaf-strewn path. It was on our way down from the Ruo Plateau that I caught the first frog among moss-grown boulders on the east bank, then, after recrossing the Ruo immediately below the Falls, a large one among leaves on the west bank. By this time it was again overcast and dark with rain threatening. Ten minutes later we took the other twenty-eight frogs within an area of a 100 square yards between the path and the river bank. It began to rain but not another frog was seen during the rest of the way down the mountain to the power house.

Arthroleptis stenodactylus whytii Boulenger

Arthroleptis whytii Boulenger (? part), 1897e, Proc. Zool. Soc. London, pp. 801–802, pl. xlvi, fig. 3: "Masuku Mts." (restricted), i.e. Misuku Mountains, Nyasaland. Boulenger (part), 1898b, p. 474; Johnston, 1898, p. 361a.

♂ (M.C.Z. 27444) Misuku Mtns. 6.x.48.
♂, 5 ♀♀ (M.C.Z. 27445–9) Nchisi Mtn. 30.xi.–2.xii.48.
♂ (M.C.Z. 27450) Cholo Mtn. 25.iii.49.
3 ♂♂, 7 ♀♀, 26 juv. (M.C.Z. 27460–9) Mlanje Mtn. 11–13.viii.48.

Records. The type locality had better be restricted to the "Masuku Mtns." (B), for as has been shown elsewhere the material allegedly collected by Whyte on the "Nyika Plateau at 6000–7000 ft." consisted largely of lakeshore fauna that does not occur so high. The third locality "Kondowe to Karonga" is on the lake shore just south of Mwaya. This led me (1933h, p. 378) to refer two immature (20–21 mm.) frogs from Mwaya to *whytii*. When submitted to my colleague, Mr. Benjamin Shreve, for an impartial opinion without reference to locality, he assigned them to typical *stenodactylus*. Subsequently I was able to examine both "Nyika" and "Kondowe to Karonga" frogs, now macerated, so that their limbs extend as far forward as in *whytii* and renders them difficult to place; also they are young and the metatarsal tubercles are subequal in length to their respective distances from the tip of the inner toes.

Affinities. While the mountain and lowland races are unquestionably distinct, differing greatly in size; individuals, especially young frogs,

are almost impossible to separate. Swollen finger tips are not always developed in *whytii* and the shovel-shaped metatarsal tubercle of that forest form is not always blunter than in typical *stenodactylus* which has to burrow into harder terrain. The tubercle in the Nehisi frogs, for example, appears just as acuminate as in most *stenodactylus*. In *whytii* ♀ ♀ the throat and breast is usually variegated with dusky, in *stenodactylus* ♀ ♀ it is white. The ♂♂ of both races have the sublabial region and throat anteriorly almost black.

As Boulenger gave the snout to anus length of *whytii* as 40 mm. it is reasonable to restrict the name to the mountain form. This means that *lönnbergi* Nieden (1915: Usambara Mtns.); *s. uluguruensis* Loveridge (1932: Uluguru Mtns.); *vagus* Ahl (1939: Usambara Mtns.); and *ukamiensis* Ahl (1939: Uluguru Mtns. is where the Wakami dwell) must all be referred to the synonymy of *whytii*. Of this race we have also many examples from Chirinda Forest, Selinda Mtn., Southern Rhodesia. While the two races are most distinct in Tanganyika, they are less so in Nyasaland and probably least so in Southern Rhodesia. I am indebted to Mr. Shreve for painstakingly examining every individual in our very extensive series of the two forms.

Native name of Whyte's *Arthroleptis*. *Mboru* (Chewa; Ngoni).

Variation. Diameter of tympanum half, or rather less than half, the orbital diameter; only an occasional finger or toe dilated at the tip; tibio-tarsal articulation of the adpressed hind limb barely reaches the tympanum or eye; ♂♂ with a relatively longer third finger.

Color. The adult ♂♂ are distinguished by dusky chins. In life the frogs from Lichenya Plateau, Mlanje, were "pale leaf-brown with dark brown markings; a pinkish tinge chiefly noticeable on fingers and toes." Most Nehisi frogs were variegated yellowish buff, like the leaves carpeting the forest floor over which they were hopping, but the largest ♀ was gray.

Size. Snout to anus of ♂♂, 23–35 mm.; of adult ♀ ♀, 29–44 mm.

Breeding. In August ova were small. On December 2 a pair, the ♀ gravid, were found beneath a fallen tree trunk where the ♀ may have retired to lay (for in this species eggs are deposited in a burrow and metamorphosis takes place in the egg). Four of the 5 Nehisi ♀ ♀ were distended with ova.

Diet. Chiefly crickets in those examined.

Enemies. One frog was recovered from the stomach of a sylvicoline snake (*Crotaphopeltis h. tornieri*).

Hibernation. In mid-August on Mlanje Mtn. these frogs were in a

state of semi-hibernation. One was at a height of five feet from the ground under moss on the bark of a slightly sloping tree growing on the bank of a stream. Two were two-and-a-half feet from the ground embedded in damp powdered wood inside a hollow tree in a shady ravine through which a trickle of water was flowing. The three ♂♂ were all together in the soil beneath a log on the bank of a streamlet meandering among moss-grown boulders and high banks in a copse behind "Araloon." One ♀ was in the water, another deep in earth among roots on the bank opposite to the ♂♂; six young were under a sod in damp ground beside the streamlet.

Habitat. The Misuku ♂ was beneath a log in dry forest. All the Nchisi frogs were taken in forest just before or after a downpour. The Cholo specimen was brought in by a Native towards the end of a second day of continuous rain which undoubtedly had activated it.

Arthroleptis stenodactylus stenodactylus Pfeffer

Arthroleptis stenodactylus Pfeffer, 1893 (1892), Jahrb. Hamburg Wiss. Anst., **10**, p. 93, pl. i, fig. 2: Kihengo, Tanganyika Territory.
Arthroleptis whytii Boulenger (part), 1897e, pp. 801–802.
Arthroleptis variabilis Hoffman (not of Matschie), 1944b, p. 176.
Arthroleptis stenodactylus lönnbergii Hoffman (not of Nieden), 1944b, p. 176.

juv. ♀ (M.C.Z. 27776) Chitala (Exch. Nas. Mus. Bloemfontein).
3 ♀♀ (M.C.Z. 27451–3) Chitala River. 14.xii.48.
♀ (M.C.Z. 27454) Blantyre. 31.xii.46.
♂ (M.C.Z. 27455) Likabula River. 2.viii.48.

Records. The Blantyre frog was given me by B. L. Mitchell, Esq. Chitala (as Chitiala: H); Karonga to Kondowe (B); "Nyika Plateau" (? in error: B). Also frogs from Mzimba (W. Y. Turner) and Zomba (J. R. Lennon) in the British Museum.

Remarks. Chitala frogs collected by Mitchell were referred by Hoffman to *lönnbergi* on the grounds that they lacked a lingual papilla. It is present in one of the two specimens loaned me by Dr. Hoffman but I cannot detect it in the other (M.C.Z. 27776) or in one of our three Chitala specimens; it is present in the others though easily overlooked.

Variation. Diameter of tympanum about half (almost a third in M.C.Z. 27453) the orbital diameter; an occasional finger or toe dilated in the Chitala frogs only; tibio-tarsal articulation of the adpressed hind limb reaches the elbow (2) or tympanum (3); ♂♂ with a rela-

tively longer third finger.

Color. Rose pink on the red laterite soil of the Chitala district.

Size. Snout to anus of ♂, 23 mm.; of ♀ ♀, 30–34 mm.

Enemies. One frog recovered from the stomach of a sand-snake (*Psammophis s. sudanensis*).

Habitat. The Likabula specimen was in a marsh beside the river.

Hemisus marmoratus marmoratus (Peters)

Engystoma marmoratum Peters, 1854, Ber. Akad. Wiss. Berlin, p. 628: Cabaçeira, Mozambique.
Hemisus marmoratus Mitchell, 1946, p. 31.

2 ♂♂, 2 ♀ ♀ (M.C.Z. 27670–3) Mtimbuka. 11.ii.49.
♂ imm. (M.C.Z. 27674) Chowe. 12.ii.49.

Records. Mitchell, who is the first to record this species from Nyasaland, mentions no localities, but tells me his material was collected at Blantyre, Chitala, Cholo, Limbe, and Zomba. He errs (p. 31), however, in saying that the breeding habits of *marmoratus* have not been described.

Native name of the Sharp-nosed Frog. *Kaswanene* (Yao, but applied to *Breviceps* also).

Variation. First finger subequal to second; second toe as long as, or shorter than, the shovel-shaped inner metatarsal tubercle; third toe (on its longer side) equals distance from anterior corner of eye to end of snout. A semicircular skin-fold partly surrounds the shovel-shaped tubercle but there is no second tubercle, the second swelling in the middle of the foot which Peters mentions may have been a prominence resulting from a slightly shrunken condition of the foot.

Color. Below, creamy white, the ♂♂ thickly, the ♀ ♀ sparsely, stippled with minute brown spots.

Size. Snout to anus of ♂♂, 28–29 mm.; of ♀ ♀, 30–35 mm.; immature ♂, 24 mm.

Habitat. Beneath fallen palm trunks at Mtimbuka; under rubbish in Dr. Lamborn's garden at Chowe; their presence above ground resulting from a heavy downpour.

BREVICIPITIDAE

Breviceps mossambicus Peters

Breviceps mossambicus Peters, 1854, Ber. Akad. Wiss. Berlin, p. 628: Mozam-

bique Island and Sena, Zambezi River, Mozambique. Günther, 1893 (1892), p. 555; Boulenger, 1897e, p. 801; Johnston, 1897, p. 362; 1898, p. 361a; Mitchell, 1946, p. 31.

Breviceps verrucosus Boulenger (not of Rapp), 1891a, p. 309.

Breviceps mitchelli Hoffman, 1944b, Soölog. Navors. Nas. Mus. Bloemfontein, **1**, p. 182, fig. 10: "Chitiala," i.e. Chitala River, Nyasaland. Mitchell, 1946, pp. 31, 42; Rose, 1950, p. 95, fig. 56.

1 (M.C.Z. 27675) Misuku Mtns. 13.x.48.
1 (M.C.Z. 27676) Kasungu. 15.ix.48.
2 (M.C.Z. 27677–8) Mtimbuka. 18.ii.49.
2 (M.C.Z. 27679–80) Lujeri R. 2.iv.49.
25 (M.C.Z. 27681–700) Cholo Mtn. 12–26.iii.49.

Records. Chitala (as "Chitiala" for *mitchelli:* H); Fort Hill (B); Lake Nyasa (B); Misuku Mtns. (as Masuku: B); Shire Highlands (G). I have also seen specimens from Fort Johnston (Sir H. H. Johnston) and Zomba (J. R. Lennon) in the British Museum; while Mr. Mitchell tells me he has taken "*mitchelli*" at Blantyre, Cholo, Limbe, Zomba and Zomba Mtn.

Native names. Chibwatiko (Ngoni); *kaswancne* (Yao); *lukumbu* (Misuku); *nantusi* (Manganja); *nasancne* (Nyanja).

Synonymy. The description of *mitchelli* was based on a 26 mm. frog which, through Dr. Hoffman's kindness, I have been allowed to see. Though said to be an adult it had not been dissected and the sex was not stated. Incidentally the testes are recognizable in a ♂ (M.C.Z. 27680) of only 23 mm. in length. There is a surprising dimensional difference between sexes in the genus *Breviceps.* Hoffman omitted to say how his solitary specimen supposedly differed from *mossambicus,* but I agree with his description of *mitchelli* where he says: "interorbital space nearly 1¾ times as broad as upper eyelid;" and of the outer metatarsal tubercle "small, conical and distinct from the inner." Now Parker's (1934, p. 187) monograph of the family, used by Hoffman, states of *mossambicus:* "interorbital space a little broader than the upper eyelid;" and of the outer metatarsal tubercle "small, compressed, almost continuous with the inner." Both conditions exist in the Cholo series. The interorbital width merges into the upper eyelid in so many Cholo frogs that it is quite impossible to say where one ends or the other begins, i.e. the character is valueless; in young frogs the tubercles tend to be separate but grow together in old individuals; Parker's description is much the more accurate. Though I failed to get any topotypic *mitchelli* on account of the prevailing drought, the

habitat is just what one would expect for *mossambicus* which is known from all the countries surrounding Nyasaland. I see no grounds for supposing that *mitchelli* can be distinguished from *mossambicus*.

Variation. Orbital diameter contained 6.6 (M.C.Z. 27678) to 13 (M.C.Z. 27697) times in length from snout to anus when the length of the orbit in millimetres is divided into the length from snout to anus taken by dividers; orbital diameter contained 7 (M.C.Z. 27678) to 16 (M.C.Z. 27695) times in length from snout to anus if the length of the orbit is taken with dividers and marked off across the back from snout to anus. Not only is there clearly a change in proportions with growth, but an element of error results from whether the eye is open or closed and whether the frog is excessively fat. Consequently the major division (II) of Parker's (1934, p. 187) key, which calls for the length of the eye to be "contained less than 9 times in the length from snout to vent;" is valueless. The rest of the key characters for *mossambicus* hold, viz: Fingers and toes distinct; outer finger less than two-thirds the length of the second and extending somewhere between the subarticular tubercles of the third; outer toe (fifth) sometimes vestigial (M.C.Z. 27676; 27684), never extending beyond the junction of the third and fourth. Skin pitted, but not warty.

Color in life. Unsexed Cholo adult. Above, yellow brown, paler on head and almost white on the blunt-ended, wedge-shaped streak that covers the nostril and both upper and lower jaws; it is followed by a broad black band extending from eye to anterior edge of forearm; behind this is a conspicuous, sub-triangular, yellowish-cream patch extending from the posterior corner of the eye to the parotid gland and tapering downwards on to the upper arm, also continued posteriorly along the whitish flanks as an ill-defined lateral line, marbled and speckled both above and below with sepia blotches and spots; limbs dark. Below, chin and throat black (in both sexes) breaking up into black spots on the chest which is otherwise white like the belly and inner aspects of limbs. Usually the chest and belly are whitish minutely stippled with brown, but occasional individuals *of both sexes* may exhibit large irregular dark blotches.

Size. Snout to anus of four ♂♂, 23–35 mm.; of four ♀♀, 36–52 mm.; of entire series, 16.5 to 52 mm.

Breeding. In March, surprisingly enough, the ova were enlarged in only one of the four ♀♀ examined, nor were the others spent, but all those dissected had large reserves of fat.

Diet. Only ants and termites in the stomachs of those examined.

Enemies. Young *Breviceps* were in stomachs of three vine-snakes (*Thelotornis k. capensis*) and one white-lipped snake (*Crotaphopeltis h. hotamboeia*) taken at Cholo on March 17, 19, 21 and 22.

Defense. Under the stimulus of chloroform or cyanide these frogs exude a thick, white, and very sticky secretion from the dorsal glands.

Habitat. The Kasungu frog was found beneath a canvas bag in my tent, doubtless having been induced to emerge during the drought by water seeping from my canvas bath. At Mtimbuka, though there had been no rain for a week, the smallest frog was out on a path at 9 A.M., the second was found sheltering beneath palm fronds. One Lujeri frog was dug from the ground beneath a log where it was in close proximity to an ants' nest. Heavy rain was responsible for the fine Cholo series most of which were brought in by tea-pickers from Mianga Plantation.

Phrynomerus bifasciatus bifasciatus (Smith)

Brachymerus bifasciatus A. Smith, 1849, Illus. Zool. S. Africa, Rept., pl. lxiii: "Country to the east and north-east of Cape Colony."

Phrynomantis bifasciatus Boulenger, 1882b, p. 172; 1891a, p. 308; 1897e, p. 801; Johnston, 1898, p. 361a.

Phrynomerus bifasciatus Mitchell, 1946, p. 30.

Phrynomerus bifasciatus nyasalandensis Hoffman, 1944b, Soolog. Navors. Nas. Mus. Bloemfontein, **1**, p. 181, fig. 9: "Chitiala," i.e. Chitala River, Nyasaland.

Records. Chitala (for *nyasalandensis:* H); "Nyika Plateau" (B: undoubtedly erroneous); Shire Valley (B); also Zomba (in Brit. Mus.). Mitchell tells me he has collected *bifasciatus* at Chikwawa; Chiromo; Chitala; Fort Johnston and Port Herald.

Synonymy. Hoffman described *nyasalandensis* on the basis of a single 30 mm. juvenile ♀, citing the following differences:

Character	*nyasalandensis*	*bifasciatus*
Snout	more pointed	less pointed
Second finger	equal to fourth	shorter than fourth
Third toe	slightly longer than fifth	shorter than fifth
Hind limb	longer	shorter

In any long series of *bifasciatus* a certain amount of variation in the shape of the snout is to be seen, sometimes quite striking. Though the second finger is normally shorter than the fourth, for example in juveniles (M.C.Z. 25524–5) from Lindi, others (M.C.Z. 25222–3) in

the same series have the second and fourth equal, as also in four adults (M.C.Z. 21379–82) from Pretoria, Transvaal. While normally the third toe is shorter than the fifth, third and fifth are occasionally equal, for example M.C.Z. 16412 in a normal series (M.C.Z. 16410–25) from Mwaya, Lake Nyasa. Presumably comparative material for an extensive study was not available to the describer of *nyasalandensis*, whose alleged differences are only of an individual nature.

Since writing the foregoing, through the courtesy of Dr. Hoffman, I have been privileged to examine the type of *nyasalandensis* and consider it agrees with *bifasciatus* in three of the four characters listed above, differing only in the second finger being of unusual proportions. The impression of a more pointed snout may be due to the juvenile type having been undernourished during its period of captivity.

Color. During my visit to the London Zoological Gardens, Miss M. Southwick showed me three fine adult *bifasciatus* that were normally colored when received in January, 1948. About June, 1952, one of the three turned white and was still white when I saw it in August, 1952.

Habitat. The three frogs mentioned above had been taken by Mr. B. L. Mitchell in the petioles of banana plants at Chiromo, Nyasaland.

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SYNOPTIC KEY TO AID IN THE IDENTIFICATION OF NYASALAND AMPHIBIANS

(WARNING! No easy aid of this nature should be followed blindly. It requires to be used with discretion and in conjunction with a full description of the species after due consideration of the probabilities and alternatives. This is especially the case when dealing with such genera as *Hyperolius* and *Arthroleptis* whose range of variation is often little known. Furthermore, supposing a second, as yet undiscovered, species or genus of caecilian is present in Nyasaland, the first alternative of the key would merely direct the enquirer to *Scolecomorphus kirkii*.)

1. Body without limbs, tailed, wormlike; habitat montane, subterranean, coming to surface during or after heavy rain (Caeciliidae) . . *S. k. kirkii*
   Body (except in tadpole stage) with four limbs, without (except when emerging from tadpole stage) tail, froglike . . . . . 2 (Salientia)
2. No tongue; three inner toes bear black horny-sheathed claws; toes very fully webbed as habits wholly aquatic; fingers finely tapering to their pointed tips . . . . . 3 (Pipidae)
   Tongue large; toes without claws; fingers not pointed 4
3. Subocular tentacle much shorter than half the orbital diameter; black claws, when viewed from above, appear flattened . . . . . *X. l. laevis*
   Subocular tentacle at least half the orbital diameter; black claws, when viewed from above, appear compressed . . . . . *X. mülleri*
4. Upper jaw toothless 5
   Upper jaw toothed 9
5. Skin more or less rough, warty . . . . . 6 (Bufonidae)
   Skin smooth or pitted, but not warty . . . . . 49 (Brevicipitidae)
6. Tympanum large and conspicuous (except in very young); a tarsal fold;

first finger subequal to, or longer than, second when pressed together . . 7
No tympanum; no tarsal fold; first finger shorter than second when pressed together 8

7. Transverse diameter of tympanum subequal to, or slightly larger than, that of eye; parotid glands absent or indistinct; a post-temporal and dorsolateral glandular fold separates back and flanks; first and second fingers subequal when pressed together; toes slightly webbed . . *B. carens*
Transverse diameter of tympanum usually much smaller than that of eye; parotid glands large and distinct; no post-temporal or dorsolateral glandular folds; first finger longer than second when pressed together; toes half to two-thirds webbed . . . . . *B. r. regularis*

8. Back with a light, hair-like, vertebral line (best seen with a lens); breast and belly usually immaculate or at most with a few dark vermiculations; adults ♂♂ 28–34.; ♀♀ 35–42 mm.; known only from the Nyika Plateau at 7000 feet . . . . . *B. t. nyikae*
Back without any vertebral line; breast and belly with a large, anteriorly three-pronged, dark patch surrounded by dark spots and vermiculations; ranges from Kenya to Mozambique at relatively low altitudes, unknown from Nyasaland but likely to occur there . . . . (*B. t. taitanus*)

9. Tips of fingers and toes ending in disks (except in *Kassina*[1]); disk joint separated from next by an intercalary cartilage (dissection necessary); habitat chiefly in bananas, sedges, shrubs and trees . . . . . 10 (Rhacophoridae)
Tips of fingers and toes not dilated (except in some *Arthroleptis*[2]); terminal joint not separated from next by cartilage (dissection necessary); habitats: aquatic, terrestrial, fossorial, but not arboreal . . . . . 24 (Ranidae)

10. Two innermost fingers opposed to the two outer; pupil horizontal; a large putty-colored or brownish tree-frog which makes a froth nest . . . . . *C. xerampelina*
All four fingers in the same plane 11

11. Tips of fingers and toes not dilated, fingers free of web, toes almost so; vomerine teeth present on palate between the choanae (nasal openings) *K. senegalensis*
Tips of fingers dilated; toes usually webbed extensively 12

12. Tympanum distinct; vomerine teeth present on palate between the choanae (nasal openings); pupil vertical 13
Tympanum usually hidden; vomerine teeth lacking; pupil vertical or

[1] An inch-long, silvery gray to pale bronze frog whose back bears three black-edged, brown streaks which may be broken up into shorter streaks or blotches; similar blotches along jaw and sides. Males may be recognized by their black throats bearing a straight-sided disk. Their distinctive call resembles the loud pop made by the removal of a reluctant cork from its bottle.

[2] All *Arthroleptis* lack vomerine teeth and have no noticeable web between their toes, are mostly of small size and are consequently apt to be mistaken for young *Rana*. Cf. pp. 405 - 406 for synoptic key and chart.

horizontal 15

13. Scarlet patches on armpit, groin, fore and hind aspects of thigh, inner and upper surfaces of foot; above black marbled or blotched with deeper black, each spot faintly margined in silver. Omosternum largely forked posteriorly; metasternum a large cartilaginous plate not, or but slightly, calcified . . . . . *H. maculatus*

No scarlet coloring, which is largely brown or green. Omosternum entire, broadened at base; metasternum without a bony style but usually strongly ossified . . . . . 14 (*Leptopelis*)

14. Tips of fingers and toes only slightly dilated; outer toe a quarter-webbed; heel of forward-pressed hind limb reaches shoulder . . . . . *L. bocagii*

Tips of fingers and toes terminate in large disks; outer toe webbed to disk; heel of forward-pressed hind limb reaches eye; young frogs vivid green, differing from green or brown adults in having a white spot on each elbow and heel . . . . . *L. flavoguttatus*

15. Pupil vertical (when dilated may usually be recognized by a nick above and below) . . . . . 16 (*Afrixalus*)

Pupil horizontal (when dilated may usually be recognized by a nick on either side) . . . . . 17 (*Hyperolius*)

16. Fingers well webbed; heel of the forward-pressed hind limb rarely fails to reach the eye and sometimes extends beyond; adults usually more than an inch in length from snout to anus . . . . . *A. f. fornasinii*

Fingers indistinctly webbed at base; heel of the forward-pressed hind limb reaches the shoulder but never the eye, adults usually less than an inch in length from snout to anus . . . . . *A. b. brachycnemis*

17. Fourth toe with 2 phalanges free of web; color very variable; occurs on Nyika Plateau at 7000 ft. . . . . *H. marginatus*

Fourth toe with at most 1 phalanx free of web; usually occurs at low levels and probably not above 6000 ft. 18

18. Fourth toe webbed to disk or with half a phalanx free of web; from snout to anus a white vertebral line on a black or marmorate background, alternatively frog devoid of markings but associating with the marmorated form . . . . . *H. m. albofasciatus*

Fourth toe usually with 1 phalanx free of web (or a narrow seam may extend to the disk in some examples of *c. tuberilinguis*) 19

19. From snout to eyelids no light Ω-shaped marking (unless possibly in unknown young); adult ♂♂ 33–36 mm., uniformly putty colored above except for an indication of a dusky streak from nostril to eye; ♀♀ (33–) 39 mm., uniformly plumbeous (green in life) above (except on thighs) . . . . . *H. c. tuberilinguis*

From snout over eyelids (and possibly continued along either side of back) a light (yellow or white), with or without black border, Ω-shaped marking; back with or without spots 20

20. Light Ω-shaped marking relatively slender, when edged with black, the

black lines are parallel....21
Light Ω-shaped marking broadens out behind eye....22

21. Color brown to pale brown (green when young); usually some spots scattered over back; size moderate, viz. ♂♂ 20–28 mm., ♀♀ 20–32 mm.; habitat: swamps of Lower Shire and Zambezi....*H. a. argus*
Color rosy brown; spots, if present, rudiments of a disintegrated dorso-lateral line; size relatively large, viz. ♂♂ 25–35 mm., ♀♀ 32–43 mm.; habitat: montane slopes of Misuku, Nyika, and Mlanje....*H. p. puncticulatus*

22. Color rosy brown; dorsal spots, if present, large, white, usually encircled with black; size largish, viz. ♂ 32 mm., ♀ 40 mm.; habitat: montane *H. p. cholocnsis*
Color pale; dorsal spots, if present, small, black; size moderate, viz ♂ 25 mm., ♀ 31 mm.; habitat: lake shore (but only known from types) *H. p. mitchelli*
Color pale green or straw; spots, if present, minute, serially arranged in a double dorso-lateral and a single vertebral series; size small, viz. ♂♂ 20–24 mm., ♀♀ 19–23 mm....*H. nasutus*

24. Vomerine teeth present (except in very young frogs recently emerged from tadpole stage)....25 (*Rana*)
Vomerine teeth absent....37

25. Inner metatarsal tubercle large, hard, shovel-shaped (though less distinctly so in young); tibio-tarsal articulation of the forward-pressed hind limb reaches only to the axilla; habit bloated or toad-like....36
Inner metatarsal tubercle moderate, softish, an elongate oval pad, not shovel-shaped; habit frog-like....26

26. Vomerine teeth in two slightly separated series directly between, but not touching, the choanae....27
Vomerine teeth in contact with the inner anterior borders of the choanae from which they extend posterio-obliquely inwards, the two series widely separated (narrowly in the alternative group assigned to No. 36 above)....29

27. From eyelids to groin a conspicuous, pale brown, flat, glandular, dorso-lateral fold; throat uniformly white....*R. g. bravana*
No dorsolateral fold, or, if indicated, neither conspicuous, pale brown, nor broad; throat more or less vermiculated with dusky markings....28

28. Overall length of tibia more than half the length from snout to anus....*R. f. angolensis*
Overall length of tibia about half (±) the length from snout to anus....*R. f. fuscigula*

29. Last phalanx of fifth toe fully, or partially, webbed....30
Last phalanx of fifth toe entirely free of web....32

30. Only 1 phalanx of fourth toe free of web; tibio-tarsal articulation of the forward-pressed hind limb reaches far beyond end of snout; light

markings on buttocks tend towards vermiculations; size large; habitat: montane streams ..... *R. o. gribinguiensis*

1½ to 2 phalanges of fourth toe free of web; tibio-tarsal articulation of the forward-pressed hind limb reaches eye or well (*but not far*) beyond end of snout; size relatively small; habitat: lowland streams and ponds 31

31. Tibio-tarsal articulation of the forward-pressed hind limb reaches end of snout or, more usually well beyond; buttocks with a more or less well-defined light stripe bordered by black ..... *R. o. oxyrhynchus*

Tibio-tarsal articulation of the forward-pressed hind limb only reaches eye or nostril; buttocks finely vermiculate with black ..... (*R. floweri*)

32. Only 2 phalanges of fourth toe free of web, and only 1 of the first toe free ..... *R. m. mascareniensis*

At least 3 phalanges of fourth toe free of web, and 2 of the first toe free . . 33

33. Only 1 phalanx of fifth toe free of web, and only 1½ of the second and third toes free 34

2 or more phalanges of fifth toe free of web, and 2 or 3 of the second and third toes free 35

34. An inner and a well-developed outer metatarsal tubercle on hind foot; habitat in lowlands ..... *R. m. mossambicus*

Only an inner metatarsal tubercle, though the position of an outer may be indicated by a spot; habitat in uplands ..... *R. m. uzungwensis*

35. 3 phalanges of fourth toe free of web, and only 2 of the third and fifth toes; males with a pair of black-lined gular sacs whose slits are situated below the angle of either lower jaw ..... *R. ansorgii*

4 phalanges of fourth toe free of web, and only 3 of the third and fifth toes ..... *R. f. fülleborni*

36. Front of lower jaw with three slight swellings; metatarsal tubercle of forward-pressed hind limb reaches shoulder or eye; back with rounded glandular warts ..... *R. d. delalandii*

Front of lower jaw with three well-developed bony cusps; metatarsal tubercle of forward-pressed hind limb reaches or, more often, fails to reach, the armpit; back smooth or with elongate glandular folds ..... *R. a. edulis*

37. A tarsal tubercle in addition to an outer and inner metatarsal tubercle 38 (*Phrynobatrachus*)

No tarsal and no outer metatarsal tubercle, only an inner metatarsal tubercle ..... 43 (*Arthroleptis* & *Hemisus*)[1]

38. Only 1 phalanx of fifth toe free of web; toes terminating in disks ..... *P. perpalmatus*

1½ to 3 phalanges of fifth toe free of web; tips of toes usually not dilated (except in *u. ukingensis*) 39

39. 1½ to 2 phalanges of fifth toe free of web, and 2½ to 3 of the fourth toe

[1] See also chart of characters on p. 406.

free 40

3 phalanges of fifth toe free of web, and 4 of the fourth toe free 41

40. Dwarf form (breeding ♂♂ 22–24 mm.; gravid ♀ 26.5 mm.) with usually rather more webbing . . . . . *P. duckeri*

Common form (breeding ♂♂ 26–35 mm.; gravid ♀♀ 28–35 mm.) with less extensive webbing . . . . . *P. natalensis*

41. Black above; heavily infuscated below; tibio-tarsal articulation of the forward-pressed hind limb usually fails to reach the eye; habitat: Nyika Plateau at 7000 ft or more . . . . . *P. u. nyikae*

Brown above; white below except for black throated ♂♂; tibio-tarsal articulation of the forward-pressed hind limb usually reaches the eye; habitat: below 5000 ft 42

42. Toes without disks or dilations; habitat: lowland or upland marshes . . . . *u. mababiensis*

Toes with disks or dilations; habitat: within, or at edge of, northern montane forests . . . . . *u. ukingensis*

43. First finger shorter than second; metatarsal tubercle shorter than inner toe (except in some *s. whytei* where it is subequal); habitat: virgin forest 44

First finger as long as, or longer than, second; metatarsal tubercle as long as, or longer than, inner toe 47

44. Belly white heavily marbled with black at all ages from 8 to 23 mm. . . . . *A. x. nyikae*

Belly white, uniform 45

45. Metatarsal tubercle half as long as inner toe; tips of fingers and toes usually slightly swollen or distinctly dilated; size small (breeding ♂♂ 14–18 mm., gravid ♀♀ 18–24 mm.) . . . . . *A. boulengeri*

Metatarsal tubercle at least three-quarters as long as inner toe; size larger, adults averaging about 10 mm. longer than *boulengeri* 46

46. Toes terminate in well-developed disks; metatarsal tubercle three-quarters the length of inner toe . . . . . *A. reichei*

Toes without disks, though their tips may be more or less swollen; metatarsal tubercle slightly shorter than inner toe; tibio-tarsal articulation of forward-pressed hind limb reaches eye or just beyond . . . . . *A. a. francei*

47. Metatarsal tubercle usually shorter than, occasionally as long as, inner toe; tibio-tarsal articulation of forward-pressed hind limb reaches tympanum or rarely eye . . . . . *A. s. whytii*

Metatarsal tubercle usually longer than, in young occasionally only as long as, inner toe 48

48. Snout rounded; mouth normally placed; metatarsal tubercle occasionally as long as (in young), usually longer than inner toe; tibio-tarsal articulation of forward-pressed hind limb reaches elbow or shoulder, very rarely the tympanum . . . . . *A. s. stenodactylus*

Snout pointed; mouth inferior, shark-like; metatarsal tubercle much longer than inner toe; tibio-tarsal articulation of forward-pressed hind limb fails to reach axilla in ♀ ♀, reaches axilla or shoulder in ♂ ♂ . . . . *H. m. marmoratus*

49. Fingers and toes pointed; inner metatarsal tubercle hard, shovel-shaped, *much* longer than inner toe . . . . . *B. mossambicus*

Fingers and toes with well-developed disks; inner metatarsal tubercle pad-like, round, *much* shorter than inner toe . . . . . *P. b. bifasciatus*

Synopsis of Characters in the Arthroleptis and Hemisus of Nyasaland

This synopsis is offered to aid the novice in the difficult task of separating members of these genera. The frequently striking differences in size, when sexed, are often masked by the prevalence of young frogs. Once known, the species can be readily recognized, though not the two forms of *stenodactylus* whose subadult characters are only average.

All agree in possessing a head that is no wider than the body; a skin that is smooth; toes practically devoid of web, showing, from the first to fifth toe the following phalanges free of web — 2, 2, 3, 4, 3; and there is only an inner (no outer) metatarsal tubercle.

Species	*Metatarsal tubercle as long as inner toe ?*	*Tibio-tarsal articulation of adpressed hind limb reaches*	*First finger shorter than the second when pressed together ?*	*Tips of the toes swollen or with distinct disks ?*	*Habitat*
A. x. nyikae	¼	tympanum or just beyond	Yes	slightly or distinctly	moist ground in evergreen montane forest
A. boulengeri	½	tympanum or beyond eye	Yes	slightly or strongly	"
A. reichei	¾	eye or end of snout	Yes	slightly or strongly	"
A. a. francei	slightly shorter	eye or just beyond	Yes	strongly	"
A. s. whytii	usually shorter; subequal	tympanum or rarely eye	subequal to or longer	occasionally a toe dilated sometimes not	"
A. s. stenodactylus	usually longer; subequal	elbow or shoulder, rarely tympanum	subequal to or longer	usually no toe dilated or swollen	arid savanna
H. m. marmoratus	longer	axilla in ♂♂, but not so far in ♀♀	subequal to or longer	No	"